SINGLE PHASE MOTORS.

It can be shown mathematically and proved experimentally that the weight of copper required to transmit a given amount of power by electricity, is inversely proportional to the electromotive force or voltage employed. Inasmuch as high pressures cannot be used with direct-current motors, it has been the aim of designers of electrical apparatus to perfect a motor that will operate satisfactorily with alternating current. The necessity for such a motor is particularly urgent for railway service which requires the transmission of great power over long distances. While electricity has been gradually entering the field of traction, its fullest development will not be reached until the alternating-current motor is assuredly a commercial and practical success. American designers have been working chiefly toward perfecting the single-phase motor, although in Europe, three phase systems, notably the Ganz, appear to be in successful operation. In the *Railroad Gazette*, April 8, last, was a description of the single-phase, alternating-current motor developed by the Westinghouse Company. In this issue is a description of a similar type of motor developed by the General Electric Company. It is not our intention to discuss the relative merits of the two motors. Future experience will settle that point. It is of interest, however, to know that two of the largest American electrical companies have developed a single-phase motor, which at least gives a measure of assurance that many of the limitations hitherto preventing the more extended application of electricity to long distance railroading, will shortly be overcome. It is by no means intended to convey the impression that the direct-current motor will be relegated to the scrap heap. For many classes of railway service the direct-current motor is, and always will be, the best type of apparatus. For example, the New York Central has decided to use direct current for operating its trains at the New York terminal. The principal consideration in making this decision was the necessity of specifying a tried and proven system. A road like the New York Central could not afford to take any chances with systems that have not been thoroughly tried. The movement of trains is paramount to economy in first cost or cost of operation. Furthermore, the use of alternating current would have made necessary the use of overhead conductors which would have involved the road in legal difficulties, owing to the fact that it has no so-called "air rights" over the Park avenue viaduct. Of course, the third rail could be used for the transmission of high potential alternating current, but it would be a constant source of danger to employees of the road and to passengers in case of derailment. Both the Westinghouse and the General Electric motors will operate by direct current, so that interurban cars can pass over the tracks of local electric railway lines which are operated by direct current.

The alternating-current motor will greatly simplify the operation of long-distance electric railways. Power can be transmitted from a central station at 30,000 or 40,000 volts over a comparatively small and inexpensive conductor. Transformer sub-stations can be placed at intervals and the power stepped down to 2,000 or 3,000 volts, which is the working pressure on the trolley line. Transformer stations do not require constant attendance, one man taking care of several. Where direct current is used, the power is transmitted from the central station at high voltage to the sub-stations, the same as above noted. Each sub-station, however, must contain step-down transformers and rotary converters. The converter changes the alternating current into direct current, the usual working pressure on the trolley line being from 500 to 600 volts. Rotary converters require constant attendance and get easily "out of step." They also add to the first cost of an installation.

COMPARATIVE LOCOMOTIVE TESTS IN GERMANY.

From February 8 to March 31 continuous tests were made on a level section of the Prussian State railroads (the Moselle Railroad) of three kinds of freight locomotives, all with the same number of driving and trailing wheels. One was what is called a twin engine, another a compound, and a third a superheater. In all cases the trains hauled consisted of 120 axles, that is, in nearly all cases, of 60 four-wheel cars. The result of the tests was that the compound consumed 11.12 per cent. less water and 9.75 per cent. less coal than the twin engine, while the engine using superheated steam consumed 25.33 per cent. less water and 15.25 per cent. less coal than the twin engine, and 16 per cent. less water and 6.08 per cent. less coal than the compound. The expenditure for lubricants, which has been an objection to the use of superheated steam, was in the proportions of 48 for the twin, 51 for the compound, and 60 for the superheater. The oil required for the latter cost a little more than twice as much per gallon as that used on the other two. The cost of lubrication was one of the points which the tests were intended to establish.

A second series of tests with two locomotives of each of these kinds was conducted during the whole of the month of March on a line over the hilly country between Karthaus and Coblenz. The highest permissible load here for the new superheater engines was 110 car axles (in earlier experiments only 100 were hauled), and with this load the time-table speed of 21 miles an hour on the open road was readily maintained. The other two kinds of engines could haul only 90 axles over this section. The superheater here consumed 29.9 per cent. less water and 20.46 per cent. less coal than the twin engine, and 19.78 per cent. less water and 11.40 per cent. less coal than the compound. The cost of lubrication was in the proportions of 58, 62 and 68 for the twin, compound and superheater, respectively. The temperature of the superheated steam reached a maximum of 608 degrees, with a pressure of 178 lbs. in the valve chest. On grades, 35 per cent. cut-off usually sufficed, rising exceptionally on curves and with head winds to 40 and 45 per cent. There was always abundant steam and water in the superheater boilers at the summit of long grades, where they were usually exhausted in the other engines. A special advantage of the superheater on this line was that it required no helper over one of the steep grades. Its movement was remarkably smooth. The screwing of the piston-head upon the piston-rod is noted as a defect, as almost all pistons became loose after considerable service.

The result of these experiments is considered so important that the Minister of Public Works has called the attention of all the directories to them.

The Germans have been pioneers in the application of superheated steam to locomotives, and apparently with success. The Prussian State Railways are using superheated steam on both freight and passenger locomotives. The engines are fitted with both Schmidt and Pielock superheaters. One of the latest Atlantic type locomotives fitted with the Pielock superheater is exhibited at St. Louis. In the early attempts to use superheated steam the principal difficulty was in maintaining continuous and effective lubrication of the moving parts exposed to the high temperature of the steam. This difficulty seems to have been overcome, however, by using a mineral oil. It has also been necessary to redesign the valve and valve chests of engines using superheated steam. Some tests have already been made in this country with locomotives fitted with a superheater, notably on the Canadian Pacific, while other roads intend to experiment along this line. There has never been much doubt as to the thermo-dynamic efficiency of engines using superheated steam. In fact, data is plentiful showing that the cylinder efficiency of both stationary and locomotive engines having simple cylinders and using superheated steam is higher than that realized from compound engines using saturated steam. The perfection of the superheated steam locomotive will settle an important problem in locomotive engineering, making it possible to obtain all the advantages of compounding without introducing the objectionable features. Of course, the addition of the superheater adds to the complication of the boiler, but experience so far shows that the superheater is not expensive to maintain nor unduly liable to failure in service.

THE FRANCHISE IN CAPITALIZATION.

In the last Legislature of Massachusetts a measure which received its *quietus* near the end of the session a few weeks ago quite failed to attract the outside attention merited both by the novel points which it raised and by its character as a proposed inversion of the Massachusetts policy in regard to capitalization of public service corporations. The bill was reported favorably by the Committee on Street Railways, though, as it appears, after somewhat hasty and inadequate consideration, was then strenuously opposed by the Railroad Commission of the State, as represented by its chairman, but was passed by the Senate; and, finally, after considerable discussion pro and con in the press of the State, was defeated by a considerable majority in the lower House. Not until almost at the last was the significance of the bill fully measured.

It was styled a bill "for an extension of

the corporate powers of the Western Massachusetts Street Railway Company," under which title it was sought to build up in the western part of the State a great street railway system which, potentially, might include the street railways of Springfield and other cities. But the special charter—which the bill in effect was—went in its gift of power and privilege far beyond mere geographical plans of merger and consolidation. In the first place, the new company could buy out the stocks and bonds of other railways—at market value—giving its own stocks and bonds in return; it could condemn, under rulings of the courts and its appraisers, the minority shares of dissenting stockholders apparently without any ruling on the public interest, as required by the new Connecticut law; and the corporation could go into the business of supplying heat, light and power to corporations and persons. Massachusetts has stoutly and consistently opposed capitalization of steam and electric roads on any other basis than replacement value; this bill proposed to let a new corporation capitalize on a basis of market value of absorbed companies, and then, to a large degree, capitalize the franchises and what may be called "non-physical" elements. Massachusetts has also, thus far, refused to let street railway companies supply heat, light and power to other corporations and persons, though, we believe, they can sell electricity *en bloc* to a municipality; this bill allowed the street railway company to cross the old barrier and establish a precedent that would certainly be followed by a general demand of other street railway corporations for the same privilege.

But the most interesting point was raised in the debate by the advocates of the bill. The State of Massachusetts, it was said in substance, allows a prosperous street railroad to pay dividends which carry the stock up to, say, $180 or $200 a share. Has not such a company, in effect, capitalized its franchise along with its other assets of earning power? Again, with what consistency can it require—under its law of sale of new issues of stock at market value—new buyers to pay a higher price for the "franchise" factor, whatever it may be, than the original investor; or, if that original investor takes his new stock, to pay an enhanced price as a result of his own good judgment and the presumptive good management of his corporation? Ought the State thus to fix indirectly two values for franchises and, in a sense, penalize successful street railway administration? And, if it does so, does it not at least sacrifice consistency? In the case of the Western Massachusetts bill the theory of the State as to replacement value advances a step further in paradox and forbids an outside company to invest on the same basis of market value which it insists upon in the case of the individual. It proposes one rule for the corporative shareholder, another for the private stock owner. This was one of the arguments in the debate and it certainly had a theoretical force.

It can be met, in part at least, by the counter pleas that, in relation to public interest an investing corporation undoubtedly stands on a different plane from an individual; that the corporation has special powers that the individual has not; that, if the State fixes different and varying franchise values the original investor knows it when he enters a street railway or steam railroad enterprise, and the principle of *caveat emptor* applies; and, finally, that perhaps some inconsistency in an occult financial question can be pardoned in State policy if the end of restraining over-capitalization is gained, to the benefit of public interest. Massachusetts, in the case of this particular bill, is the first State, we believe, to raise in her legislature and in concrete shape this question of variable valuation of franchises as a basis of capitalization. Most of our commonwealths either dodge the principle entirely or leave the whole subject in so obscure a form in their statute books that it loses all practical value in application and, under either general or special acts—or both—corporations in fixing capital accomplish their ends without much legislative resistance or controversy.

The theories of primary or secondary capitalization of the public service corporation in the main can be reduced to three. There is (1) the replacement value, or, what is substantially the same, capital based on actual and honest oulay. It is the conservative plan, subject only to the minor criticism of variation of cost at different periods and of penalty paid to virtue by some loss of enterprise in a State which, like Massachusetts, adopts it. There is (2) capitalization based on earning power, a variable quantity, subject to mutation and abuse and going largely on the theory of absolute corporative ownership of the franchise; and (3) a combination of the two foregoing theories, with net earnings divided so as to pay a fair return on original investment and the rest capitalized into a franchise value and returned as a percentage to stockholders or the State or the municipality, according to the idea of franchise ownership. The last theory, in which Michigan to some extent has been a pioneer, is pretty academic and we shall hardly find it realized on a large scale. What we do see, however, in the complicated question of franchise values, is the constant and increasing effort both of trained economists and more callow lawmakers to reach out to the subject, albeit in a blind and groping way. Sometimes the object is taxation, sometimes lower fares, sometimes improved public service. It is the result, doubtless, of that closer and more intense relation—compared with the steam road—created by the street railway and the larger concession and value which its franchise on the highway and city street usually represents. The Massachusetts example is a case somewhat novel to-day, but which may be typical to-morrow.

While the Erie has greatly increased the number of its locomotives in the past few years, it has not increased its shop facilities in the same ratio, and hence cannot put its engines through the shops as frequently as the conditions require. Plans are under way for the construction of new shops and the enlargement of old shops, but it will take at least several years to increase the facilities so as to adequately handle the equipment. For this reason, the road has found it necessary to have some work done in outside shops, and with this end in view, arrangements have been made with several contract shops to repair engines at the rate of one a day for the next two years. In all, about 600 engines will be repaired in other than the railroad company's shops. The letting of this contract is understood to have no special significance other than above noted, as the road expects ultimately to handle all its equipment in the company's shops. However the case may be, the above mentioned contract calls to mind discussions which have frequently taken place, as to the advisability of railroads having heavy repairs made by contract. Under ordinary conditions the roads can probably repair locomotives cheaper and more satisfactorily in their own shops, but when conditions are such that contract shops are not overtaxed with new work, it is reasonable to expect that repair work can be done cheaply. Most contract shops have modern tools designed specially for certain classes of work. Comparative figures are not at hand, but it would seem that even if the actual cost of contract repairs were somewhat greater than the cost at the railroad company's shops, it might pay a road to have at least a part of its work done by contract. The road would save the interest on a large investment in tools and machinery. In any event, the success of contract repairing would depend largely on the thoroughness with which the railroad company's inspectors do their work.

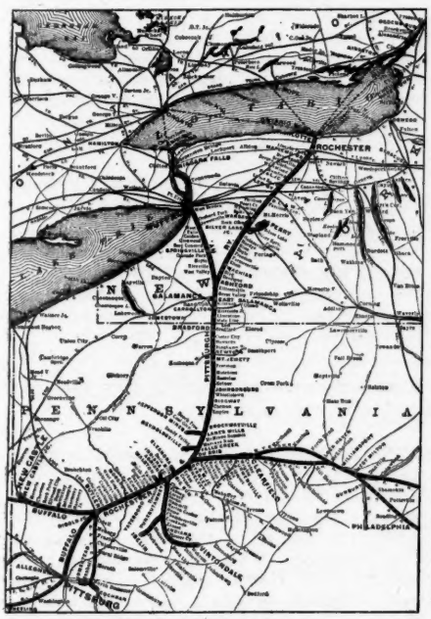
Buffalo, Rochester & Pittsburg.

The report for the fiscal year ending June 30, 1904, shows gross earnings of $7,529,958, an increase of $232,039 over last year, on a mileage worked of 499 miles, as against 472. Of the increase in gross, passenger earnings contributed $110,483, and freight earnings $134,443. The gain in the latter case is especially noteworthy, because it was made on a decreased revenue tonnage, caused by the failure of connecting carriers to promptly receive the freight offered during the winter months, on account of the severity of the weather. The ton-mile revenue increased, amounting to 5.4 mills; .1 mill more than in 1903. The average distance each ton was hauled was 147.8 miles, an increase of 2.2 miles.

The same factor, the extremely severe winter, which materially lessened the traffic of the company, also helped to swell the maintenance charges. Operating expenses for the year were $4,408,807; $331,218 more than in 1903. The largest part of this increase is credited to the maintenance of equipment and conducting transportation accounts, in which the expenses were respectively $146,224 and $113,332 more than in 1903. The ratio of operating expenses to earnings was 58.5 as compared with 55.8 in the previous year. Following the large increase in operating expenses, net earnings showed a decrease for the year of $99,179. After payments on account of interest, rentals, taxes and sinking fund, there remained $1,513,264 net income, as against $1,781,594 last year. But from the net income, an increase of $185,000 in dividends was paid on the common stock, the rate being increased from 4½ to 6 per cent. For extraordinary expenses and improvements, $92,389 was charged to net income, as against $42,015 last year, and in addition, $405,000 was appropriated for special purposes. The item of special appropriations represents the principal of the car trust bonds paid off during the year amounting to $81,000, and $324,000 of construction expenditures. Last year $908,734 was appropriated for like purposes.

Equipment obligations show the same

large increases which have been so constant a feature in the reports of this company for the last three years. During the past fiscal year a total of $974,000 equipment bonds were issued, and $2,000,000 additional were authorized. The net increase in bonded debt was $893,000, as $81,000 of car trust bonds were paid off and cancelled. The balance sheet now shows car trusts at $4,535,000, as compared with $3,642,000 in 1903, and $2,579,000 in 1902. The number of locomotives owned increased 12 during the year, and an addition of 953 cars was made to freight car equipment. The average car capacity showed a fair gain and now stands at about 32½ tons as against 31¾ tons last year. The average freight train load decreased, being 439.1 as compared with 441.5 in 1903, and the percentage of loaded cars in freight trains also showed a slight decrease, from 58.05 in 1903 to 57.91 in 1904. On August 1, 1903, 28 miles of the Indiana branch from Ernest, Pa., to Indiana Junction, were opened for traffic. Fifteen miles of second



Buffalo, Rochester & Pittsburg.

track between Ashford, N. Y., and Punxsutawney, Pa., were also placed in operation during the year, and extensive improvements were made on the yards and buildings at Buffalo Creek and Elk Run Junction, Pa. In addition a new yard was built at East Salamanca, N. Y.

The surplus of the Rochester Coal & Iron Company amounted to $598,872, and after payment of dividends a sum of $320,000 was left to be added to the profit and loss account. The Adrian blast furnace, at Falls Creek, Pa., was finished during August, 1903, at a cost of $613,498. To provide for this expenditure, $250,000 4½ per cent. sinking fund gold bonds were issued, leaving in the treasury $750,000 of the $2,000,000 bonds which were authorized last year, half of which were issued at that time. The accompanying table gives the more important statistics of operation:

	1904.	1903.
Total mileage worked	499	472
Passenger earnings	$1,038,172	$927,689
Freight earnings	6,446,365	6,311,922
Other earnings	11,983	10,076
Total earnings	7,529,958	7,297,919
Maintenance of way	589,412	532,744
Maintenance of equipment	1,134,748	988,524
Conducting transportation	2,516,643	2,403,311
Total operating expenses	4,408,807	4,077,589
Net earnings	3,121,151	3,220,330
Net income	1,513,264	1,781,595

The Uganda Railroad.

The Uganda Railroad Committee appointed by Lord Salisbury in September, 1895, to supervise building the railroad from Mombasa, on the east coast of Africa near the fourth degree of latitude south, to the upper part of Lake Victoria Nyanza through the southern part of British East Africa, has now presented its final report. After the greatest difficulties, both foreseen and unforeseen, the road was finished, so far as essentials for operation are concerned, early in 1903, although traffic was moved on such portions of the line as were ready for use, several years previous. The present report gives a general resumé of the entire situation and compares the actual results, both as regards expenses and as regards profits, with the preliminary estimates, in a highly interesting manner.

The motives that led to this remarkable project and the early progress made in the work have been quite fully discussed in previous issues of the *Railroad Gazette*. Comment was made (April 27, 1894,) to the effect that, following the advice of the late Sir Gerald Portal, the British Government had avowed its purpose of establishing a protectorate over Uganda and that Africa had far more to gain than England from such a protectorate, inasmuch as the occupation of the Central African country, so far as any commercial profit could come to England for a generation or two, at least, was a great waste of human energy. But the British Government felt that obligations had been placed upon it which could not be ignored and a government was set up in the interior of Africa, 700 miles from the coast by the shortest caravan route through the hostile wilderness between Lake Nyanza and the Indian ocean. At that time, it was estimated that the carriage of goods between these points cost from $1,200 to $1,500 a ton.

Following the reconnaisance survey in 1891 and 1892, during which a total party of nearly 500 persons, of which seven were Europeans, marched over 4,280 miles of African wilderness and surveyed 2,724 miles, the committee finally recommended that the gage should be one meter, that the road should be laid with 50-lb. steel rails and steel ties, with grades in no case steeper than 2 per cent., although these recommendations changed quite radically the character of the railroad from that originally proposed in the McDonald-Pringle report of 1892. As a matter of fact, the engineering difficulties, pure and simple, were much less formidable than the difficulties of organization of labor, supplies and the commissariat. The troubles of the East African railroad builder are well portrayed in the comment made by the committee on some of the situations which had to be met. The population of the districts traversed is so sparse, amounting to from eight to twelve persons per square mile, of whom only one-sixth are males of working age (and these highly unwilling to work) that the hope of securing native labor had to be entirely abandoned. Even under the pressure of famine in 1898 and 1899, nothing would persuade them to work continuously or systematically, and had any attempt been made to bring laborers from Uganda or elsewhere in the British sphere, it would have failed, for the fear of the slave policy was fresh in the minds of the natives and they were unable to discriminate between contract labor and slave labor.

It was decided, therefore, to bring in laborers from India; but difficulty at once arose with the Indian Emigration Act relative to the departure of laborers from India to work for hire, and, although in 1896 an amendment was passed scheduling East Africa as a country to which emigration might be permitted, the terms of the amendment were highly onerous. It was provided, for example, that the term of service was not to exceed three years, that the remuneration was to include free rations, besides payment far higher than that customary in India, where the natives provided their own food supplies in contract work. Pay was to begin not later than from the date of embarkation from India, and the laborer had to receive full protection and support from the company and "an indefeasible right to a return passage to the place of recruitment, not merely to India, at the expense of the company"—whether he worked or not. In a word, life was made so pleasant for these laborers that they scarcely worked at all, and the outturn was reported at an average of 16 cu. ft. of earth work per man per day. After another modification was made, permitting the use of task, or piece work, the railroad builders were troubled by the outbreak of plague in India and the closing of ports to emigration.

With the labor problems disposed of, there remained the exceedingly unhealthy climate; the great difficulty in obtaining water and provisions; hostile tribes, and the tsetse fly. The tsetse fly reigns supreme in the belt of country extending inland for a distance of about 250 miles from the coast, and it was frankly impossible to make use of animal transport in this belt. When the work was first started, this was attempted; but, after an aggregate loss of about 60 per cent. of the bullocks, 20 per cent. of the donkeys and 50 per cent. of the camels, it was given up. Then two special traction engines and trains of wagons were tried, and these were subsequently doubled in numbers and did much useful work, connecting with a mule service beyond the fly belt.

So, overcoming the old difficulties and solving new ones, the work gradually progressed with the rail head as a base, and the advance gangs, together with the commissariat, working out ahead in extended order, in arms always against sickness and against hostile tribes, as they made their way through the wilderness. From the coast terminus at Mombasa to Port Florence on Victoria Nyanza, the northwestern terminus of the line, right under the equator, the distance is 584 miles by the route built, and the paying traffic, so far as it exists, consists of copra, beans, grain, hides and skins, and ivory, besides which, from Lake Nyanza, there is rubber, oil seed and coffee. The only traffic figures on hand are those for the year 1902-1903, when the steamer service now established on Lake Nyanza did not exist. The committee compares the actual returns for this year with the preliminary estimates made ten years earlier and submitted to Parliament; and, on the whole, the closeness of this early estimate with the results actually obtained is quite surprising. The comparison is shown in the following table:

	Anticipation of 1893.	Actuals, 1902-03.
Passengers (coaching), parcels etc.	£25,375	£24,303
Mail subsidy	1,000	2,761
Exports, i. e., down traffic, 3,511 tons	16,500	6,612
Imports, i. e., up traffic. 12,694 tons	19,075	53,652
Total	£62,000	£87,328

It will be seen that the passenger business was very close indeed to the estimate; that the mail subsidy was higher than estimated, and that, although exports were considerably less, the imports were far greater than preliminary figures. It is to be feared that the 12,694 tons of up traffic represent to a large degree what we are accustomed to account as company business and that this was

charged up at commercial figures. Nevertheless, the government business done in carrying stores to the capital of the Protectorate was undoubtedly very considerable, and it is evident that the same government business done by the old caravan method would have cost vastly more.

It is pleasing to note that one of the prime objects of the railroad, that of stopping the slave trade of the interior, has been fully accomplished, and the committee reports that slave caravans and the transit of slaves to the coast has entirely ceased since the railroad was built. The squadrons engaged in watching that sea traffic consisted of five small cruisers, costing some $500,000 a year to maintain, and the reduction in this police work will apparently by itself go far to turn the operating deficit of the road into profit for the government. It is, of course, still too early to tell what the road is going to do commercially. The total expenditure out of parliamentary grants up to the time the committee ceased to control the outlay was $25,840,620, and the cost of the line per mile, built, bridged and ballasted throughout, with 2 per cent. ruling gradients, complete work shops and a full complement of rolling stock was approximately $46,190. By way of comparison with other African lines, the following table of costs per mile is given:

Uganda Railroad, complete	$46,190
Lagos Railroad (estimated)	34,020
Gold Coast	38,880
Congo (2 ft. 6 in. gage, heavy gradients)	48,600
Cape	51,117
Natal	53,460

The report is signed by John Kirk, Chairman, and F. L. O'Callaghan, managing member of the committee.

A rare opportunity to study the interaction of politics upon government owned and controlled industries is offered by the frequent discussions on the State railroads in the Prussian Diet. Complaints are constantly made of the way the government railroads treat the agricultural East. Minister Budde is frequently obliged to champion the government's railroad policy and to prove that the section of each complaining representative is receiving its proper attention from the government. The government is careful not to go too fully into the matter of railroad tariffs, but is always glad to emphasize the increasing surplus derived from its management of the railroads. It also has much to say about its large orders for railroad equipment, which it claims is an untold blessing to the German iron and steel industries.

In reply to the attacks of the representatives, Minister Budde is doing his best to prove that the government is not falling behind in the construction of new railroads. The question seems chiefly to involve the construction of branch lines, in themselves unprofitable, but important as feeders to the main lines, a familiar state of things in the United States. We obtain a rather comical picture of representatives of various sections appearing before the Minister pleading for new railroads, or a change in the rates. The Minister appreciates fully that each representative thoroughly and sincerely believes the extension of the railroads of his district is the most important question of the day. When deputations paint in glowing colors the prospective traffic available to a new road, the Minister—who evidently has a strong sense of humor—urges them to hurry home and build the railroad themselves.

One gathers that government ownership and control of railroads in Germany has solved the railroad question no more effectively than private ownership has done in Great Britain and the United States.

NEW PUBLICATIONS.

Rights of Trains on Single Track; by Harry W. Forman; 477 pages 4¼ x 7 in.; pocket book, bound in leather, with round corners. The *Railroad Gazette*, New York, Chicago and London. Price, $2.50.

This book is an exhaustive commentary on the Standard code of train rules of the American Railway Association, and is a thorough study—so much more thorough and complete than anything of the kind which has been attempted before as to put it beyond comparison. Mr. Forman, who is a chief despatcher on the Denver & Rio Grande, has been an examiner of trainmen and operators on that and other roads for many years, and one needs to read but a few pages of his book to see that he is an accomplished doctor in this work. Every page shows the fruit not only of experience, but of study and reflection. As will be readily appreciated by anyone familiar with the Standard code, and the process by which it has been developed in the American Railway Association during the past fifteen years, a study of this kind, by such a man, produces a most interesting treatise. Discussions of these rules in the Association have been either fragmentary and incomplete, or else so long and tedious, as to be of but moderate value to those who read them after they come out in cold type; and the reports of the committees have often been unsatisfactory because of their brevity, or of the necessity of keeping silent on disputed points. The independent individual writer is free from the restraints of a committee, and he avoids the pitfalls that surround a speaker in a convention, so that Mr. Forman's book is really the first comprehensive and satisfactory study of the Standard code that has ever been written.

The book is made up in the form of questions and answers, like the "Catechism of the Locomotive." These questions number nearly twelve hundred, covering in the most painstaking manner all of the intricate questions that come up in making examinations. Where the answer is long and is susceptible of treatment in the shape of a little lecture, such a lecture is given. Every standard rule is considered and the most common supplementary rules such as additions to 83, 104, etc., are fully discussed. Extracts from the book were given in the *Railroad Gazette* of August 19 and in several earlier issues. From these and from special articles by Mr. Forman which have lately appeared in these columns, it will readily be seen that we have here a train-rule expert who, while possessing the patience and close application necessary to plod through the interminable details of train order forms and hair-splitting rules, at the same time does not lose sight of the broad general principles. And the reader will not only like the author's literary style—the book is agreeable reading—but will also agree with him, we think, in most of his opinions.

TRADE CATALOGUES.

The Locomotive Appliance Company, St. Louis, Mo., issues a pamphlet describing the Allfree valve gear and valve for the Allfree-Hubbell locomotive. This valve mechanism is an addition to the link motion and can be supplied to any locomotive. It is claimed that this valve movement delays the opening of the exhaust port at all parts of the cut-off, thereby increasing the ratio of expansion and decreasing the terminal pressure, thus getting more work out of any given quantity of steam admitted to the cylinders. Detailed illustrations and a description of the mechanism are given, including indicator diagrams, etc.

Angus Sinclair Company, New York, publisher of Railway and Locomotive Engineering, sends a framed copy of its educational chart No. 7. This is a half-tone reproduction of a finely executed transparent wash-drawing of an Atlantic type locomotive, with each part numbered, and an index on the margin. The chart is very helpful to the layman who desires to familiarize himself with locomotive nomenclature.

Riehlé Brothers Testing Machine Company, Philadelphia, Pa., sends a pamphlet describing a 600,000 lbs. standard vertical-screw power testing-machine with dial screw beam. This machine was made for the University of Illinois, and is to be used for general testing purposes. A brief description of the machine is given, together with a large plate drawing showing two views.

The Nernst Lamp Company, Pittsburg, Pa., is distributing a pamphlet descriptive of a street lighting system which it has installed at Berwyn, Ill. Illustrations are given of the power plant, street scenes and a plan of Berwyn showing the distribution of the Nernst lamps. About 250 lamps of 60 c.p. each are in use at the present time.

The Newton Machine Tool Company, Philadelphia, Pa., is distributing Catalogue No. 39, relating to cold saw cutting-off machines. The machines which are illustrated and described are adapted to the cutting of round and square stock, I-beams, channel bars, armor plates, nickel steel and gates or risers on steel castings.

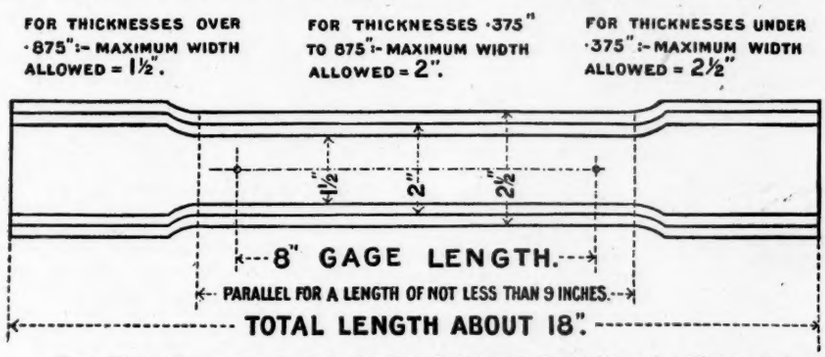
Standardization of Specifications for Iron and Steel.*

The desirability of bringing about greater uniformity in specifications governing iron and steel is generally recognized, and has found expression within recent years in the efforts of numerous technical societies in that direction. When the International Association for Testing Materials was organized at Zurich in 1895, a committee was appointed, charged as follows: "On the basis of existing specifications, to seek methods and means for the introduction of international specifications for testing and inspecting iron and steel of all kinds."

The American representation on this international committee consisted originally of five and now of eight members. In view of the magnitude and importance of the subject, the Executive Committee of the American Section of the International Association for Testing Materials, since incorporated as the American Society for Testing Materials, appointed a committee of 34 members, including the American members of the above-named international committee, to frame standard American specifications for iron and steel. This committee reported on specifications for (1) structural steel for bridges and ships; (2) structural steel for buildings; (3) open-hearth boiler-plate and rivet-steel; (4) steel rails; (5) steel splice-bars; (6) steel axles; (7) steel tires; (8) steel forgings; (9) steel castings; (10) wrought-iron. These specifications were designed to be fairly representative of the best current American practice, and were adopted by let-

*From a paper by W. R. Webster and Edgar Marburg, read at the last meeting of the American Institute of Mining Engineers. This subject has been discussed editorially in *Transport and Railroad Gazette*. A reprint of the editorial will be found in the General News Section, so as to avoid having it appear again in the English edition.

ter-ballot of the society in August, 1901. The leading engineering societies have participated at various times in the discussion of these specifications and have lent valuable assistance through the appointment of special committees on like or closely related subjects. The American Society of Civil Engineers discussed the specifications for structural steel for bridges and ships, and appointed a committee on steel rails to report on sections, methods of manufacture, specifications, and methods of testing and inspection. The American Society of Mechanical Engineers discussed the specifications for boiler-plate and rivet-steel, steel forgings and steel castings, and a committee of that society presented last year a report on these specifications, subject to revision, recommending certain modifications. The American Railway Master Mechanics' Association appointed a committee to report on the specifications for steel axles and steel forgings. This committee made a preliminary report last year, and has the matter still under consideration. The American Railway Engineering and Maintenance of Way Association appointed separate committees to report on specifications for bridge materials and steel rails. These specifications, which differ somewhat from those of the American Society for Testing Materials, were adopted by vote of the association, the


FOR THICKNESSES OVER ·875"·- MAXIMUM WIDTH ALLOWED = 1½".
FOR THICKNESSES ·375" TO 875"·- MAXIMUM WIDTH ALLOWED = 2".
FOR THICKNESSES UNDER ·375"·- MAXIMUM WIDTH ALLOWED = 2½"
1½"
2"
2½"
8" GAGE LENGTH.
PARALLEL FOR A LENGTH OF NOT LESS THAN 9 INCHES.
TOTAL LENGTH ABOUT 18".

Test Piece Recommended by English Standards Committee for Plates and Structural Material.

Widths given above, being maxima, do not exclude the use of the usual 1½ in. × 8 in. test piece.

former in 1903 and the latter in 1902. The committee on steel rails has been instructed, however, to consider certain proposed modifications. The American Institute of Mining Engineers has co-operated in this work by discussing the specifications for steel rails, steel forgings and steel castings, and is now asked to assist again by including in the discussion on the "Physics of Cast-Iron" the specifications proposed by the committee on standard specifications for cast-iron and finished castings of the American Society for Testing Materials. These specifications, which will be presented at this meeting by the chairmen of the sub-committees concerned, comprise (1) specifications and grading of pig-iron; (2) cast-iron water and gas-pipe; (3) cylinder castings; (4) car wheels; (5) malleable iron; (6) general castings and methods of testing.

The above presentation covers in brief outline the recent history of the movement on the part of technical societies in this country in the direction of the standardization of specifications for iron and steel. The desirability of arriving at some uniform basis of reasonableness in specifications governing iron and steel products is too obvious for extended argument. The ordering of material which is to be subjected to similar or identical conditions of service under a great multiplicity of specifications, differing often more in the letter than in the spirit, is harassing to the manufacturer and of no real advantage to the consumer. The latter should recognize that any unnecessary burden imposed on the manufacturer must necessarily react in the end upon the consumer, and increase the average cost of the product without attendant gain in average quality. On the other hand, the manufacturer should recognize his obligation to spare no reasonable effort or expense to ensure a high-grade product of uniform quality, and should evince a willingness to provide adequate facilities for testing.

The existing differences between the leading specifications framed within recent years are in the main on matters of minor importance, and what has been done has resulted in a considerable clearing of the atmosphere. That further efforts will be put forth to reconcile the remaining differences as far as possible cannot be doubted. If the task be approached in a fair and open spirit of compromise between interests whose divergence, broadly viewed, is more apparent than real, all parties will be the gainers. If this work be promptly initiated, it is not too much to hope that American standard specifications approved by the leading technical societies, and covering the principal iron and steel products, will be available for presentation at the seventh session of the International Railway Congress to be convened in Washington, D. C., in May, 1905, and that they will prove an important step towards the ultimate realization of international standard specifications.

Turning now to a brief review of the present situation in England, it will be seen that much the same agencies have been set at work there, and that the outlook is in some respects even more auspicious than in America.

The movement in England had its origin in the appointment by the Institution of Civil Engineers of a Committee on Engineering Standards, which began its labors in 1901. The Institution of Civil Engineers secured the co-operation of the Institution of Mechanical Engineers, the Institution of Naval Architects, the Iron and Steel Institute and the Institution of Electrical Engineers, and the appointment by these several societies of representatives on the committee. According to a recently published announcement these "five leading technical institutions are thus actively and financially supporting and controlling the operations of this important movement."

In recognition of the great national importance of this undertaking, the British Government has lately authorized a grant of $15,000 towards the necessary expenses, and the India Government has agreed to contribute an additional sum of $5,000.

The War Office and Admiralty Departments, who are among the largest users of iron and steel, are actively co-operating in this work, and there are now more than 24 representatives of the Government on the various sub-committees. Representation on these committees has also been accorded to numerous engineering, scientific and trade organizations, to the International Association for Testing Materials, as well as to the leading manufacturing and consuming interests.

The scope of the field which this Committee on Engineering Standards proposes to cover may be judged from the following list of committees and sub-committees:

1. Sections used in ship building (11 members).
   (a) Sub-committee on tests for iron and steel material used in the construction of ships and their machinery (23 members).
2. Bridges and general building construction (12 members).
3. Railroad rolling-stock underframes (13 members.)
4. Locomotives (28 members).
   (a) Sub-committee on component parts and tires (14 members);
   (b) Sub-committee on steel plates (seven members);
   (c) Sub-committee on tires, axles and springs (six members);
   (d) Sub-committee on copper and its alloys (six members).
5. Rails (22 members).
   (a) Section on railroad rails (11 members);
   (b) Section on tramway rails (four members).
6. Electrical plant (22 members).
   (a) Sub-committee on generators, transformers and motors (13 members);
   (b) Sub-committee on temperatures of insulating materials (five members);
   (c) Sub-committee on cables and conduits (11 members);
   (d) Sub-committee on telegraphs and telephones (seven members).
7. Screw-threads and limit-gages (26 members).
   (a) Sub-committee on screw-threads (26 members);
   (b) Sub-committee on limit-gages (17 members).
8. Pipe-flanges (12 members).
9. Cement (17 members).

Three of the above-named committees have considered independently the question of "Standard Sections for Rolled Iron and Steel," and have held joint meetings and have agreed upon standard sections which have been adopted and published.

It will be seen from the foregoing that the English Engineering Standards Committee is operating on lines quite similar to those adopted by the American Society for Testing Materials. Both have recognized the desirability of giving fair representations on their committees to all parties in interest, including the manufacturers. The work is divided among numerous sub-committees whose reports are submitted to the parent committee, which in turn makes its report to the technical societies which it represents.

The work in England is much facilitated, however, first from the fact that the five leading technical societies are co-operating through the medium of a single, jointly-appointed committee; and second, by reason of the liberal financial support which the Government has lent to the undertaking.

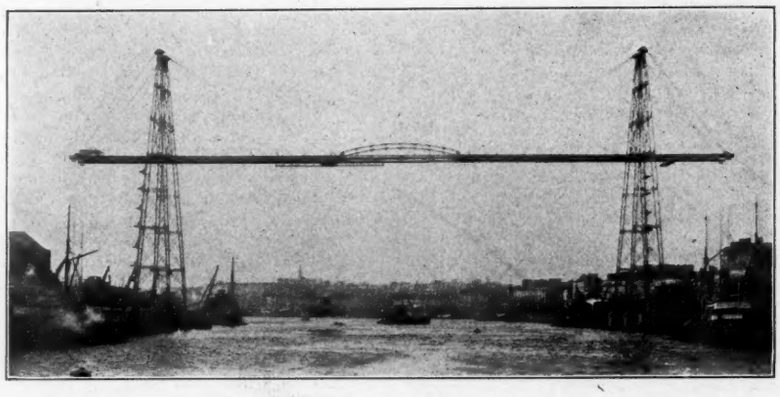
Notwithstanding certain disadvantages, however, the progress that has been made in this country during the past few years towards the standardization of specifications is distinctly creditable; and it is confidently expected that the moral and financial support for continuing this work along broader lines will be duly forthcoming.

Suspension Ferry Over the Loire River at Nantes, France.

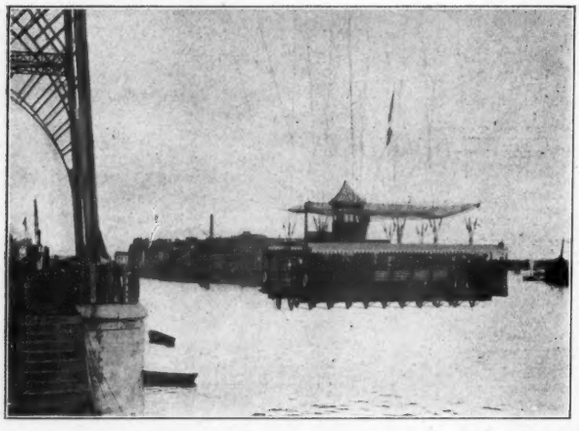
BY B. H. RIDGELY.*

The suspension ferry, or Pont Transbordeur, which has recently been built over the Loire river at Nantes, France, is a simple means for crossing a river where a strong current interferes with regular ferry boats. Although there are several other overhead ferries in existence, the most important of which are at Bilbao, Spain; Tunis, Bizerte, and at Rouen and Martrou, France, the one at Nantes is especially interesting, as it involves a new principle of construction and is the only one operated by electricity.

The Pont Transbordeur is built high up over the channel of the river and leaves the waterway free, without requiring vessels to signal or change their speed. It has no difficult approaches and lands close to the quay, or pier, thus allowing traffic to come aboard directly from the street. As it is built on an air line, it realizes the smallest possible distance for the crossing. The motive power for operating is comparatively light and the cost of construction is relatively small compared to the heavier bridges. The ferry at Nantes fully equipped cost about 800,000 francs ($160,000).



Suspension Ferry at Nantes, France.



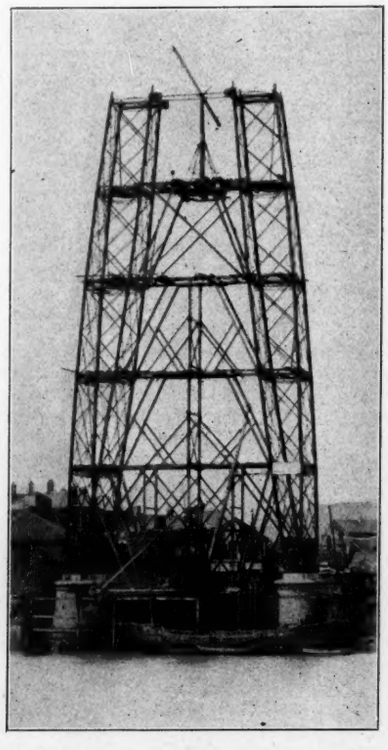
Suspension Ferry at Nantes, Showing Car in Action.

Work on this ferry was begun in September, 1902, and was finished in October, 1903. It is a graceful structure, consisting of two tall steel towers, one on each bank of the river joined together by a horizontal cantilever suspension bridge, 490 ft. long and 165 ft. above the surface of the water, anchored by cables at the ends. An inverted steel carriage travels along rails laid on the bridge and the car or ferry is suspended from this by steel cables. This car has two divisions, one for horses, vehicles and railroad cars and the other for foot passengers. Each of the four legs of the towers rests upon a separate masonry base. The heigth of each tower above the water is 250 ft., and they are capped by steel saddles weighing 8,800 lbs., over which the steel cables supporting the structure are carried. Two stationary motors at the left end of the bridge develop the power necessary for moving the traveling carriage. The watchman who directs the movement of the ferry occupies a place in a small tower on the top of the car where he can keep a lookout for passing ships. The *nacelle*, or ferry car, is built to carry a dead weight of 30 tons, and the crossing is made in about one minute. The average power necessary for operating the Transbordeur is 10 h.p. This may be reduced to 5 or 6 h.p., when there is an absence of wind. Each motor, however, has a capacity of 25 h.p. on account of occasional violent winds, which require a force of about 18 h.p. to successfully operate the car. The Pont Transbordeur at Nantes was built at the works of Mr. Arnodin, at Chateau-sur-Loire, France.

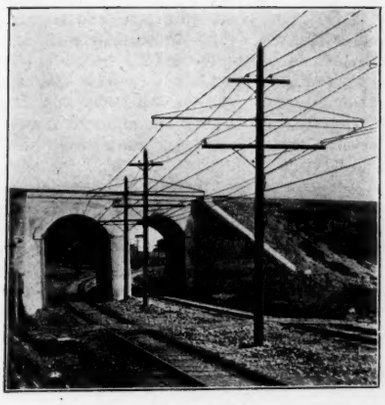
*U. S. Consul at Nantes.

In connection with the above description of the suspension ferry at Nantes, our English office sends some interesting photographs and data of a similar ferry which is now being built at Newport, England. The center span of this ferry will be 640 ft. long and 177 ft. above high water mark. The towers are of open lattice steel work and are solidly anchored to the masonry piers by steel bolts and shackles. Each tower will be fitted with a stairway carried to the level of the bridge platform. The estimated weight of steel in a tower is 275 tons. The suspension cables are 16 in number, four inside and four outside. They are connected by steel shackles to the main spindles or pins on the expansion saddles on the top of each tower, the anchoring cables being similarly connected. Diagonal cables are introduced over a portion of the span. The weight of cables and suspension parts is 293 tons. The stiffening girders are 16 ft. deep, being spaced laterally at central distances of 26 ft. 3 in. The weight of the girders and wind bracing is 539 tons. On each side of the web of the bottom boom of each girder a line of rails will be laid; on these rails will run a truck 104 ft. long, furnished with 60 wheels, 15 inside and 15 outside, on each side, with horizontal wheels engaging laterally on the edges of the flange plates. From this truck the car or platform is suspended by 30 steel cables which are crossed so as to form a trussing in order to prevent swinging motion either laterally or longitudinally. The car is 33 ft. long by 40 ft. wide. It is designed to carry a test load of 66 tons in addition to its own weight (51 tons) making a total of 117 tons in all. The car when at rest is housed in the bases of the towers, and does not project into the river. Spring buffers will be provided at each pier to arrest the motion of the car. The motive power will be electricity, the motors being controlled from the moving car. The anchorages are massive blocks of masonry built on pile concrete foundations. They are pierced with galleries for the passage of the anchor cables. The weight of masonry above and in front of the blocks taking the reaction is 1,100 tons, the calculated effort 911 tons. The total weight of each anchorage is approximately 2,000 tons. The foundation piers, eight in number, are masonry wells 20 ft. in diameter. They have been sunk by compressed air through the alluvial deposit to the marl underlying the river bed. A steel shoe, with cutting edge covered in with an

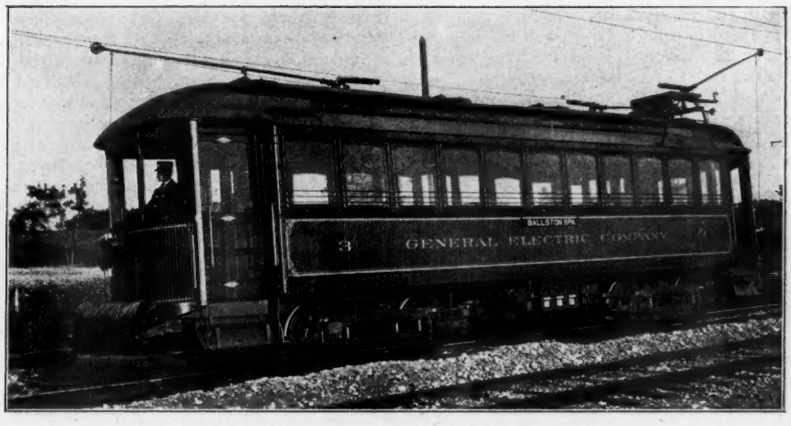
Piers for Suspension Ferry.



Suspension Ferry at Newport, England.



Ballston Line—Schenectady Railway Company.

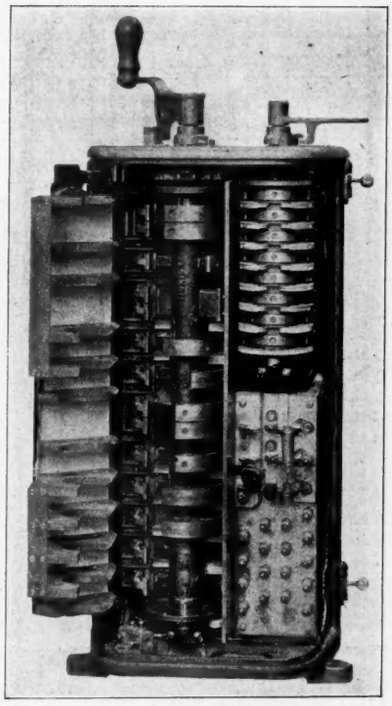


General Electric Alternating Current Motor Car—Ballston Line.

armored concrete dome forming a working chamber and fitted in the crown with the usual air shaft, was first placed in position, the sinking being performed in the usual way, the walls being carried up as the sinking proceeded. Comparatively little trouble has been experienced in sinking, though the extremely tenacious nature of the clay on the western bank presented some difficulties. The sinking has proved the accuracy of two sets of borings, taken independently by different persons. On the eastern bank the upper portion of the marl proved somewhat softer than the borings indicated, and necessitated a descent of 3 ft. lower than the contract depth in the three piers already sunk on that side. The maximum depth of foundation below the river bank is 86 ft., or 71 ft. below high water mark of ordinary spring tides. The total load per square foot of foundation is 5½ tons.

General Electric Single Phase Alternating Current Compensated Motor.

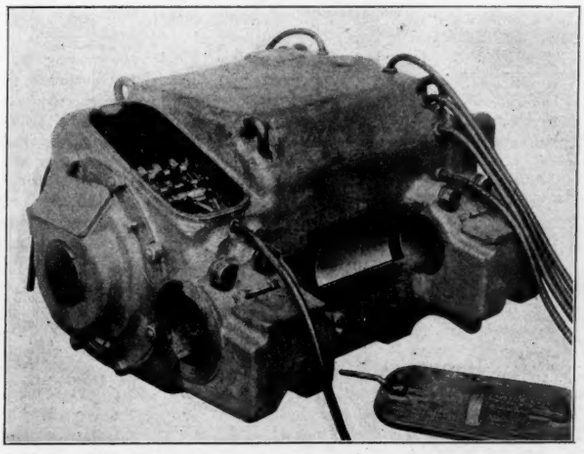
Electric railroad motors in general use throughout the world are operated, as is well known, by direct current with a trolley voltage of about 600 volts. For heavy service and extended systems the cost of copper required at 600 volts becomes a serious item, and for some time there has been felt the need of a higher trolley voltage. The use of alternating current for the trolley would admit of a higher voltage than is possible with direct current. The development of large power stations and transmission systems has been principally with alternating current, requiring rotary converters, or other commutating devices for changing the alternating current into direct current suitable for the operation of electric railways. Obviously there would be a great advantage in a railroad motor equipment that could be operated from an alternating current high voltage trolley and without the necessity of intermediate commutating devices. Such an alternating current equipment would offer a further advantage if it could be operated both on alternating extensions of existing systems, and also, on the direct current trolley where the latter is already installed.



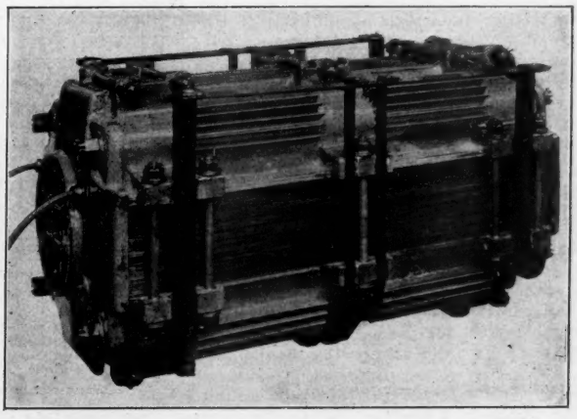
General Electric K-28 Controller.

For several years the engineers of the General Electric Company have been working on this problem, and have developed a type of alternating current equipment suitable for general traction work.

The activity displayed in Europe in adapting the three phase alternating current motor to the conditions of railroad service has never been fully shared by American engineers due to the limitations of the multiphase induction motor. The development of the single phase commutator motor and its inherent fitness for traction work has created very wide attention among railroad interests, and work of a practical nature has been actively pushed on both sides of the Atlantic. Considerable interest therefore attaches to the operation in regular service by the Schenectady Railway Company of single phase alternating current motors on its Ballston extension. This is the first instance in this country of an a.c. road in regular service carrying passengers, and its commercial possibilities are largely due to the fact that the motors operate with a.c. power out-



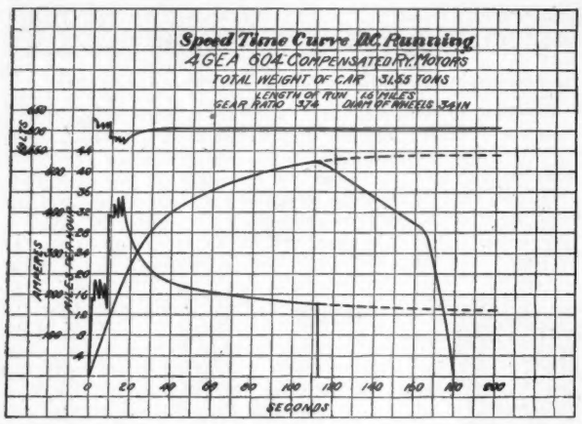
The General Electric Compensated Alternating Current Railway Motor.



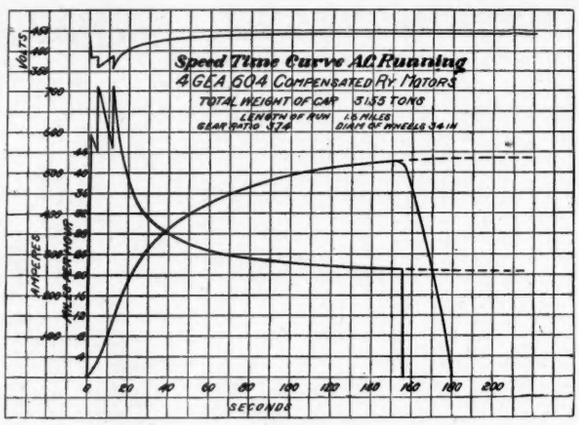
Step-Down Transformer on Car.

side city limits and with d.c. power within the city limits.

The alternating current motor as developed by the General Electric Company and installed on the Ballston line is the "compensated" type, so named on account of the character of the field winding which fully neutralizes or compensates for the armature reaction. Both the compensated motors and control are adapted for operation on the 2,000 volt a.c. trolley between cities and the standard 600-volt d.c. trolley in Schenectady. This ability of the compensated motor equipments to run over tracks equipped with either a.c. or d.c. trolley makes their field of application very broad, as the cars can secure all the benefit of running over existing city tracks without in any way sacrificing their running qualities upon suburban sections equipped with a.c. trolley.


Speed Time Curve DC Running
4 GEA 604 Compensated Ry. Motors
TOTAL WEIGHT OF CAR 315.5 TONS
LENGTH OF RUN 1.6 MILES
GEAR RATIO 3.74 DIAM OF WHEELS 34 IN
VOLTS
AMPERES
MILES PER HOUR
SECONDS

Speed Time Curve of General Electric Motor Car Using Direct Current.


Speed Time Curve AC Running
4 GEA 604 Compensated Ry. Motors
TOTAL WEIGHT OF CAR 315.5 TONS
LENGTH OF RUN 1.6 MILES
GEAR RATIO 3.74 DIAM OF WHEELS 34 IN
VOLTS
AMPERES
MILES PER HOUR
SECONDS

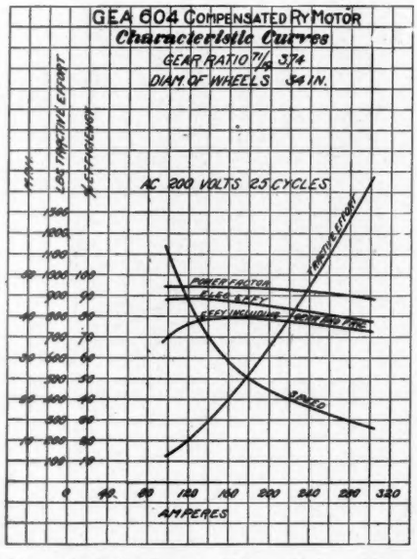
Speed Time Curve of General Electric Motor Car Using Alternating Current.

The compensated motor is essentially a variable speed motor differing in this respect from the multiphase induction motor whose constant speed characteristics proved so serious a handicap to its successful adoption in railroad work. The speed-torque characteristic of the compensated motor is very similar to that of the direct current series motor, while its commutating qualities and method of control prove equally satisfactory.

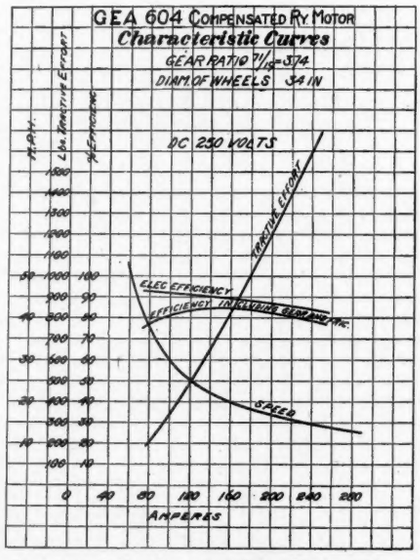
On the Ballston extension of the Schenectady Railway advantage is taken of the ability of the compensated motor to operate with either alternating or direct current. The extension is 15.5 miles long, including 3.9 miles of city running in Schenectady over tracks equipped with d.c. trolley. The interurban section is double track on private right of way, 60 ft. wide, laid with 75-lb. T rail, gravel ballast with maximum grade of 1.8 per cent. Special attention has been given to the high speed possibilities of the road and no curve exceeds 4¼ degrees.

Center pole bracket construction is used, there being two brackets supporting the two 600 volt d.c. trolley wires and a cross arm supporting the two 2,200 volt a.c. trolley wires. The Ballston extension has been operated for several months with direct current equipments, and their operation being continued in part necessitated an additional set of trolley wires for the a.c. equipments which would not interfere with the d.c. trolleys. The center poles are 34 ft. long and are spaced 100 ft. apart, the a.c. and d.c. trolley wires being No. 000 grooved section with no feeders for the a.c. trolley and with a 500,000 c.m. feeder reinforcing the d.c. trolley. The d.c. trolley conforms to standard bracket construction and presents no unusual features, while the a.c. trolley wire is suspended from a ⅜ in. steel catenary. The a.c. trolley is clipped to the catenary midway between poles and the catenary in turn is hung over porcelain insulators on wooden cross arms, the whole forming a construction of great flexibility with the further advantage of providing excellent insulation with standard porcelain insulators and eliminating the span wires adjacent to the trolley wire, thereby preventing the pole catching should the trolley wheel leave the wire. This method of trolley construction is well adapted to high potential high speed work in both its electrical and mechanical features.

With the a.c. system using a trolley and track return there is an inductive drop in the trolley and rails with an additional loss in the latter case due to eddy currents and hysteresis. Measurements made upon the Ballston line indicate an apparent trolley resistance of 1.3 times the ohmic resistance, and a rail resistance 6.55 times the ohmic resistance.



Characteristic Curves When Using Alternating Current.



Characteristic Curves When Using Direct Current.

The form of a.c. trolley adopted for the Ballston line is well adapted to the requirements of steam roads where the local service is taken care of electrically and through passenger and freight handled by steam locomotives, pending a complete change to electrical operation. The trolley wire and insulators being off-center are not exposed to the gases of the locomotive, and furthermore a catenary construction placed off-center can be hung much lower than a standard center wire without interfering with brakemen on freight cars. A low running trolley at the side of the car is also preferable in main line operation, as it conforms better to the clearance diagram of such roads without

Comparative A.C. and D.C. Resistance of Trolley and Track Per Mile of Circuit.

	d.c. Resis.	a.c. Resis. 25 Cycles.	Ratio A.C. D.C.
Two trolleys in series	.318 ohms.	.417 ohms.	1.31
One trolley and double track	.167 "	.259 "	1.55
Two trolleys and double track	.088 "	.155 "	1.76
Double track alone	.0174 "	.114 "	6.55

The resistance of the a.c. trolley wire is somewhat reduced by the steel catenary in parallel with it. The a.c. trolley wires are

calling for too great a change in height of the trolley wheel or bow.

The present sub-station of the Schenectady Railway is temporarily located at Ballston Lake. This sub-station is operated from the distributing system of the Hudson River Power Company, but owing to the fact that this system operates at 40 cycles it became necessary to introduce a frequency changing device, and an inverted converter operated from the sub-station d.c. bus bars afforded the most ready means of obtaining 25 cycle current. The permanent sub-station will be built at Ballston and the inverted converter will be replaced by a motor generator set which will give better regulation than can be obtained from an inverted rotary converter. The sub-station feeds directly into the trolley circuit at 2,200 volts with no outside transformer sub-stations.

Owing to the fact that 25-cycle three-phase generators are almost universally used to supply rotary converters in existing interurban railway systems, the General Electric Company has adapted both the design of the compensated motor and the a.c. distributing system to operate from existing 25-cycle generating stations. As the alternating current motor is single phase, a single phase generating and distributing system commends itself on account of its simplicity. The step down transformers may be tied together on the low tension side through the trolley with consequent reduction in amount of copper required. Each sub-station acts as a reserve to the adjacent one and a transformer may be cut out without shutting down a trolley section.

When it is desired to make use of or install a three-phase generator to take care of the operation of rotary converters, induction motors, etc., the preferred arrangement to balance the load at each sub-station is to install three-phase, two-phase transformers connected two-phase on the secondary side and feeding separate trolley sections from the two phases.

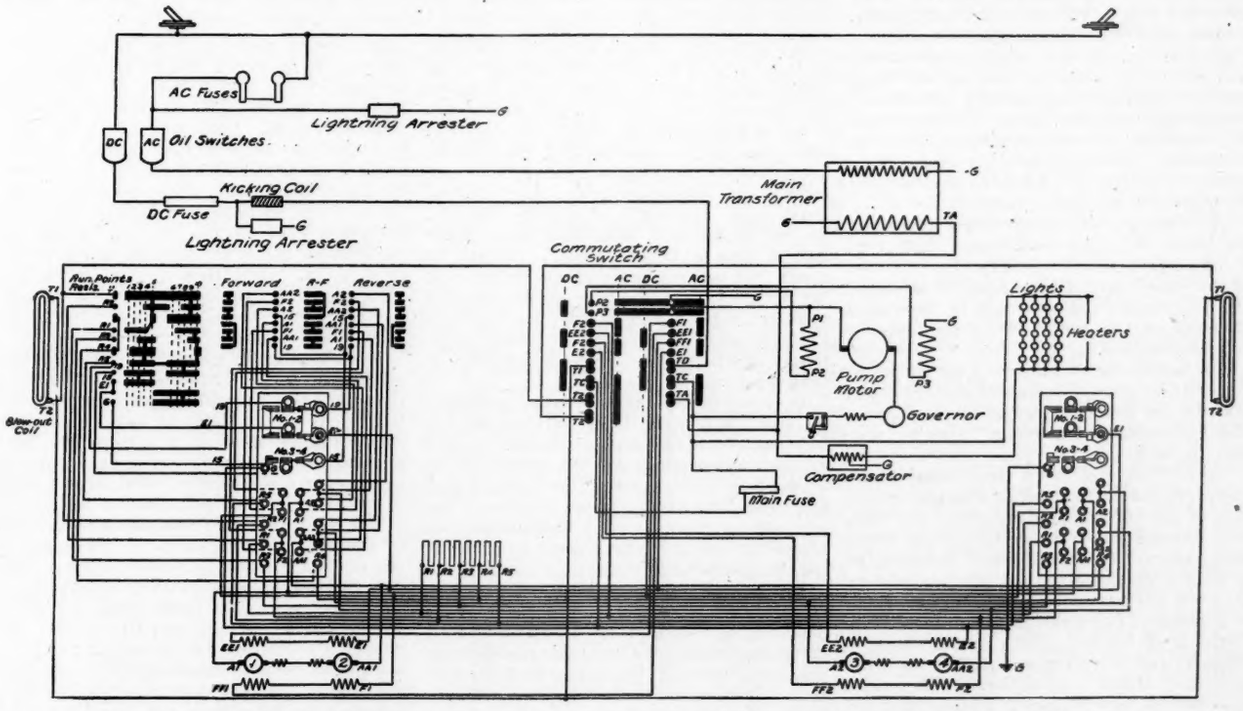
The car equipped with the compensated motors weighs 30.4 tons total without passengers and is geared for a maximum speed of about 43 miles per hour on level. The car is made by the J. G. Brill Company and has a 32 ft. body, is 43 ft. over all, and has a seating capacity of 44 passengers. The body is mounted upon Brill No. 27 trucks having 6 ft. wheel base, each truck carrying two compensated motors, each motor equivalent to a 50 h.p. direct current motor, standard railway rating.

The General Electric a.c. compensated motor consists of an annular laminated iron field with a distributed winding similar to that of an induction motor, and an armature provided with a commutator similar in general mechanical construction to a d.c. railroad motor armature. These motors are wound for 200 volts, are permanently connected two in series, and are fed from the 400 volt secondary of an 80 k.w. air blast step down transformer carried on the car. The distributed character of the field winding fully compensates for the armature reaction, so that power factors are relatively high throughout the range of operation. This type of motor is designed so that at the free running speed of the car, which is the condition most frequently met with in suburban work, the power factor and efficiency are nearly at their maximum values. A high power factor is desirable as it reduces the capacity and cost of the generating and distributing systems, and more especially effects a material improvement in the regulation of the a.c. generators. Unlike a d.c. system which has a practically constant potential at the sub-station bus bars, irrespective of the load, the drop in an a.c. railroad system is accumulative up to and including generator and engine regulation. It is desirable therefore to maintain as good a power factor as is consistent with good motor design in order to limit the total drop of the system to a reasonable amount.

A set of motor characteristics is shown in accompanying prints for both a.c. and d.c. running respectively. It will be noted that the speed-torque characteristics for a.c. running are equal to d.c. running in meeting the requirements of railroad work. Unlike the multiphase induction motor with its practically constant speed characteristic, the compensated a.c. motor varies its speed with the load and is thus better adapted to operate trains over an irregular profile. The commutation of the compensated motor is equally satisfactory when running a.c. or d.c., and this good commutation is secured by careful electrical and mechanical design without resorting to high resistance leads or other expedients liable to give trouble in case of sustained heavy overloads.

Our city railroad systems have so expanded and cover such a large territory as to make it very objectionable, both on the score of first cost and complication, to install a separate a.c. trolley at reduced potential in order that cars equipped with a.c. motors may benefit from running over city streets at termini and en route. There is a comparatively small additional expense required to adapt alternating current equipments to run either a.c. or d.c., and in the case of the Ballston line this is accomplished with the use of a standard K-28 direct current series parallel controller used in connection with a commutating switch to change field connections, cut out step down transformer, change line fuses, etc. The time required to operate the commutating switch is but a few seconds.

The commutating switch is interlocked with two main oil switches, one being in the high tension a.c. and the other being in the direct current circuit; this interlocking being so arranged that only one switch can be closed at a time and the commutating switch can only be thrown when the oil switches are in the off position. Owing to the fact that the a.c. trolley construction is off-center, while the standard city and suburban trolleys are directly overhead, it has been necessary to provide double sets of trolleys, one for a.c. and the other for d.c., hence the necessity of interlocking the oil switches and commutating switch to prevent trouble should both trolley poles accidentally be up at the same time. Where center wire construction is used on both the city and suburban sections, the a.c. and d.c. trolley wires may be overlapped for a short distance to



Car Wiring Diagram for K-28 Controllers with Four G. E. A.-604 Motors for Alternating and Direct Current.

facilitate changing from one trolley to the other.

With equipments operating with both a.c. and d.c. power it is preferable to utilize the standard series parallel controller in order to minimize weight of controlling apparatus. Such a method of operation will not give quite so high efficiency when accelerating with alternating current as could be obtained with potential control. This difference in efficiency, however, is very small due partly to the infrequency of stops occurring upon those sections of the road equipped with a.c. trolley, but principally due to the flexible character of the speed-torque curve of the a.c. motor which gives a high efficiency of acceleration with series parallel control.

With modern suburban cars, especially those equipped with train control, air-brakes, air compressors, etc., there is some difficulty in suitably locating the proper apparatus, even when equipped for d.c. running only. With cars equipped for both a.c. and d.c. running, using series parallel controller, there will be required but slightly more space and weight than for d.c. running only. Should, however, advantage be taken of the slightly better efficiency of a.c. potential control, such cars must be operated a.c. upon both suburban and city sections with the resulting disadvantages, or the installation of two separate controlling systems must be considered, necessitating a considerable increase in weight and difficulty in providing room for the necessary apparatus.

The efficiency of the potential control is not over 2 or 3 per cent. higher than that of the series parallel control, but the use of the latter, permitting operation both a.c. and d.c., secures the advantage of the higher efficiency of the motors when running d.c. over city streets.

For locomotive or other service where no necessity exists for operation over city d.c. systems, the potential method of control may offer advantages sufficiently great to warrant its adoption.

The 80 k.w. step down transformer is air cooled, forced draught being obtained by motion of the car itself, although in the Ballston line the forced draught has been found unnecessary. The transformer is suspended below the car floor and all primary leading in wires are carried in brass tubing which is grounded. Car lighting and heating is effected from the d.c. trolley in the standard manner, and from the a.c. trolley from the secondary of the transformer. Trolley poles and wheels are standard design, the a.c. trolley pole being somewhat shorter as this wire is lower than the d.c. trolley. The base of the a.c. trolley is treated with vacuum compound and further insulated from the car body by composition insulators. The air compressor for the brakes and whistle is operated by a compensated motor which operates from both a.c. and d.c. circuits.

It is instructive to compare the performance of the compensated motor equipment when operated with a.c. and d.c. current. A set of speed-time runs is shown herewith taken over the same stretch of track with a.c. current and repeated with d.c. current. The d.c. speed-time and ampere-time curves are typical and require no particular comment. The a.c. run taken under exactly similar conditions over the same track illustrates what can be expected from series parallel control with compensated motors. The rate of acceleration is somewhat lower in the a.c. run, hence requiring the application of power up to the moment of braking. The shape of the speed-time curve also is characteristic of alternating current motor work, that is a comparatively short time on the controller with a large amount of motor curve acceleration. The short period of fractional voltage running of alternating current motors makes the method of their control of secondary importance and largely minimizes the economy of potential control over series parallel control.

All speed-time runs taken on the Ballston line were made over a distance of 1.6 miles on tangent level track at an average speed of 32 m.p.h., or a schedule speed of 29.5 m.p.h., including 15 second stops. The compensated motor equipment has thus demonstrated its ability to make as high schedule speed as any suburban road now operating direct current equipments under like conditions. The following constants apply to both sets of runs:

Comparative A.C. and D.C. Runs.	d.c.	a.c.
Length of run, miles	1.6	1.6
Weight of car, tons	31.55	31.55
Time, seconds	180	180
Average current, power on, amperes	229	346
Average voltage	606	425
Volt amperes, full speed on level	98	110
Volt ampere hrs. per ton mile of given run	86.3	125.5
Average speed, m. p. h.	32	32
Schedule speed, including 15 sec. stop, seconds	29.5	29.5

The lower volt-ampere hours per ton mile of the d.c. run is partly due to the better efficiency and power factor of the compensated motor when run d.c., and partly due to the somewhat higher rate of acceleration, permitting some coasting and resulting in a more efficient speed-time curve. The difference in volt-amperes a.c. and d.c. depends upon the length of a given run and the values approach each other more nearly with a run of greater length. It will be noted that the compensated motors run the car at practically the same speed with 200 volts per motor a.c. and 300 volts d.c. This uniform speed is obtained by series paralleling the fields as shown in diagram of connections.

The operation of the Ballston compensated motor equipments will be watched by railway engineers with much interest, as their success will demonstrate the fitness of the alternating current motor for heavy suburban and interurban mixed service. The compensated motor, having demonstrated its fitness for traction work, opens up possibilities in converting main line steam roads which were closed to the d.c. motor and rotary converter combination on the score of first cost and cost of operation. The form of trolley suspension used on the Ballston line is capable of being operated at more than 2,000 volts, which together with its excellent mechanical construction helps to solve the question of current collection of heavy units at high speeds.

Sampling, Analyses and Preparation of Coal.

BY F. R. WADLEIGH.

Although our knowledge of the qualities of different coals through chemical analyses has greatly increased in the last four or five years and much more attention is being paid now to this subject both by consumers and producers, yet the value of many analyses to the user of coal for steam making purposes is greatly lessened, first by the lack of proper knowledge as to what proportions of the different ingredients should be looked for in a good steam coal, and second by the fact that comparatively few of the interested persons know how (or else they purposely fail) to sample coal for analysis properly. As a result of the latter fact, many analyses are entirely valueless because they do not fairly represent the coal analyzed. In many cases the samples are picked to show the best possible analyses; while in other cases (especially where there is an object in so doing) samples are purposely taken that will give an unsatisfactory analysis.

The above remarks regarding the value of coal analyses do not, of course, take into consideration the ability of the chemist who makes the analysis. Any good chemist should be able to make an accurate analysis of coal; but, on the other hand, no analysis should be considered of any value unless made by a well-trained chemist. The methods of sampling coals for analysis are as follows.

Sampling Coal from the Seam Inside the Mine.—The mine map should be examined and the sampling points selected so as to represent the average of the coal. All of these points should be near places where the coal is being mined and not in worked out portions of the mine. Before sampling, have the face of the coal stripped so as to clear away any smoke deposited from the powder used in mining. Place a cloth on the floor to catch the coal and then make a cutting about 3 in. wide and 1 in. deep from top to bottom of seam, leaving out such impurities in the seam as are rejected in mining and preparing coal for the market. Break up the coal on the cloth into pieces not to exceed ¼ in. cubes, then quarter down the sample and put the remaining quarter into a glass jar or bottle and seal it so as to exclude air and moisture.

The above is, in general, the method recommended by the American Chemical Society for taking samples from a mine. Getting at the fuel value of coal from mine samples taken as above is satisfactory from a geological standpoint or for the purpose of showing a prospective buyer of the mine the quality of the coal. But if the object of the analysis is to give the possible user of the coal information as to the value of the coal as shipped for steam making, then this method is open to this serious objection; that a sample taken from the mine, which leaves out any impurities that are supposed to be rejected in mining and preparation, does not necessarily represent the average of the coal as shipped to the market, because the miners are usually paid by the car or ton, and as impurities such as slate, bone and sulphur band take up as much space as and weigh more (generally) than the coal, the miners are not at all particular, unless very closely watched, to leave out the impurities when loading the mine cars. It is just as much work to them to mine impurities as to mine the coal, and consequently if they can load impurities as well as coal without being detected they will certainly do so. It will be readily seen, therefore, that analyses made of samples taken from the mine are quite likely to show better than analyses of samples taken from the coal as shipped.

In this connection, the following description of some methods used in cleaning and preparing bituminous coal for shipment will be of interest.

Inside Inspection.—This method consists in doing all of the cleaning inside the mine, using a system of mining that will best keep the impurities from getting mixed with the coal and seeing that the impurities are not loaded in the mine cars.

Outside Inspection.—In loading coal for shipment by this method, practically all of the cleaning is done on the outside, either

by the use of picking tables and conveyors or else by cleaning coal as it goes into the railroad cars. Where coals are high in ash and sulphur, it is generally found necessary to wash them, especially when such coals are to be used for making coke. Washing may reduce slate from 20 per cent. in coal to 8 per cent. or 10 per cent. in coke.

Outside and Inside Inspection.—This has proved the best plan for getting out the impurities and for maintaining an average standard of analysis. The method as used in the Pocahontas field of West Virginia is as follows.

All coal is *mined*, that is, undercut by picks or machines, and not shot down "from the solid."

Mining inspectors see that the above is carried out, that the shots are properly fired, and that impurities are not loaded by the miners.

If it is found, when a mine car is to be dumped at the tipple, that it contains an undue amount of impurities, the miner is either docked of the car or else it is taken back into the mine and the miner who loaded it has to unload it.

At the bottom of the tipple chute, where the railroad car is loaded, is placed a gate moved by hand or steam by which the flow of coal into the railroad car is regulated. The inspector stands on a platform at the opposite side of the car and allows a certain amount of coal to run into the car. His helpers—or "bone pickers," as they are called—then go through this coal, raking it with long picks, and throw out any impurities they may find. The inspector is required to make a daily report of each car he loads, showing the car number, percentage of lump coal in car, and the condition of the coal as it comes from the mine cars, whether it is clean or not. If he finds that the coal comes from the mines with too much slate, he reports at once to the mine foreman who knows by the check numbers on the mine car which miner loaded it. By this method, every pound of coal loaded for shipment is cleaned by the inspectors, who are held responsible for seeing that the coal is in proper condition before they accept it. In addition to having one or more inspectors at each mine, there are also a chief inspector and two assistants, the duties of the latter being to go from mine to mine, instructing the inspectors and seeing that they perform their duties properly, besides making reports to the chief inspector of the general condition of the coal at each mine. The work of these inspectors is checked by the chief inspector making occasional trips to various plants using the coal, seeing it unloaded and used in furnaces, and by occasionally having analyses made of samples taken from the railroad cars after being shipped.

The above is probably the most elaborate and rigid system of inspection used in any coal field in this country, and has been found to be very successful in keeping the coal up to a certain standard of analysis.

Sampling Coal as Used Under Boilers or When Testing Coals at a Stationary Boiler Plant.—A few representative shovelsful should be taken from various points in the pile of coal, or from each barrow or boiler-room car, the whole spread out and broken into ¼ in. cubes. Then it should be quartered down until about 6 oz. is left.

When a regular boiler test is being made of any coal, the best method of sampling is that adopted by the A. S. M. E. in its code of rules for boiler tests. This, in substance, is as follows.

From each barrow load or fresh portion of coal taken from coal pile select a representative shovelful and put it in a barrel or box in a cool place, keeping it until end of trial. Mix all of the samples, break them to 1 in. in diameter, quarter and crush until a final sample of 5 lbs. is obtained, all of which will pass through ¼ in. meshes. From this sample fill two 1 qt. air-tight glass jars. The coal contained in these jars is to be used for the chemical analysis.

Sampling Coal by Railroads to Determine the Average Analysis of Coal as Used on Their Locomotives.—For this purpose, samples should be taken at the coaling stations from the coal after being unloaded from the cars. Care should be taken to get a fair average of the coal from each car from which sample was taken, and a record kept of the car number, date, and mine from which coal came. The samples should be quartered and crushed as in methods given above. Unless for a special purpose, or during a test, samples should not be taken from coal loaded on locomotive tenders, as such samples will not always fairly represent the average of the coal as received from the mines; and if the railroad uses coal from different mines it is generally impossible to tell the car or mine from which such coal came.

From the above it will be seen that correct analyses of coal should represent the coal as mined and shipped to the open market. Such analysis will be of great value to the consumer as well as to the miner or shipper.

Kinds of Analyses.—The proximate analysis is the form generally used, and gives the percentage of the following substances contained in the coal: Moisture; fixed carbon; volatile matter; sulphur; ash. This kind of analysis is enough for all practical purposes and will give anyone with a little knowledge of chemistry and combustion a fair idea of the quality and kind of coal analyzed, although it will not always show the exact practical value and efficiency of the coal under all conditions of its use.

Moisture in coal has, of course, no value as fuel and is a dead loss. The amount of voiatile combustible matter shows the kind of coal, whether anthracite, semi-bituminous or bituminous, whether the coal will make much smoke or not, and for what purposes and under what furnace conditions it will give the best results. As a general rule, coals that contain about 20 per cent. of volatile matter will give the most heat under ordinary conditions.

Fixed carbon is the main combustible in coal, and under ordinary conditions the steam making value of the coal is in proportion to the percentage of fixed carbon it contains. The fixed carbon is the least volatile constituent of the combustible part of the coal, remains in the furnace longest, and it is easiest to mix with approximately the amount of oxygen necessary for its complete combustion. Sulphur, while it will burn and make some heat, is detrimental to the coal, as a coal high in sulphur will generally clinker badly. Ash in coal is, of course, an entire loss as far as heating value is concerned; and, generally speaking, the value of a coal to the user is lessened as the percentage of ash is higher.

The various losses from ash may be given as follows: From the unconsumed carbon it contains, which may run from 10 to 60 per cent. Losses due to ash stopping up grates and retarding combustion. Loss from cleaning fires, as the greater the percentage of ash the more often the fire must be cleaned. Loss due to the handling of ash and taking it out from boiler room.

It sometimes happens, however, that a coal containing a certain amount of ash will have a greater final efficiency than another coal with less ash. For instance, a coal with 6 per cent. ash may make very little clinker, while a coal with only 3 per cent. ash may make a very troublesome clinker. The writer knows of one case of the kind, where two coals were up for examination, which contained about the same amount of iron, lime

PROXIMATE ANALYSES.

Anthracite Coals.

Name of Coal.	Authority.	H_2O.	Fixed Carbon.	Volatile Matter.	Sulphur.	Ash
Jeddo	Pa. Geol. Survey	3.862	85.319	3.242	.533	7.044
Spring Mountain No. 4	Pa. Geol. Survey	3.756	84.727	3.376	.331	7.410
Spring Brook	Pa. Geol. Survey	3.652	87.569	3.116	.451	5.212
St. Nicholas	Pa. Geol. Survey	2.494	80.288	4.040	.604	12.574
Turkey Run	Pa. Geol. Survey	3.510	79.660	3.622	.584	12.624
Panther Creek No. 3	Pa. Geol. Survey	2.930	88.181	4.290	.556	4.043
Panther Creek No. 5	Pa. Geol. Survey	3.040	83.706	4.656	.542	8.056
Panther Creek No. 11	Pa. Geol. Survey	2.706	77.986	4.684	.884	13.740
Lehigh	Peabody & Miller	1.97	86.49	4.35	.64	7.19
Lykens Valley	Peabody & Miller	1.50	81.07	7.84	.50	9.59
Drifton	Peabody & Miller	1.37	89.11	3.59	.56	5.93

Semi-Bituminous and Bituminous Coals.

Alabama.

Name of Coal.	Authority.	H_2O.	Fixed Carbon.	Volatile Matter.	Sulphur.	Ash
Pratt	Proc. A. I. M. E., 1895	1.51	61.60	31.48	.918	5.42
Pratt	Proc. A. I. M. E., 1895	...	56.89	28.28	1.52	13.77
Pratt	Proc. A. I. M. E., 1895	...	56.91	26.89	4.65	11.55
Cahaba	William Kent	2.00	53.08	32.90	0.68	11.34
Cahaba	Ala. Geol. Survey	1.098	59.632	34.670	1.275	4.60
Cahaba	Ala. Geol. Survey	1.609	54.879	30.541	1.141	12.911
Corona	Hawley Furnace Co.	0.83	50.69	41.12	....	7.36
Gamble	U. S. Navy Reports	1.88	61.96	25.57	0.435	10.59
Montevallo	Ala. Geol. Survey	1.858	54.002	36.592	1.726	7.548

Arkansas.

Bonanza	U. S. Navy Report	0.63	80.61	15.35	.365	3.41
Denning	St. Louis Samp. & Test. Co.	1.07	78.01	11.21	1.58	8.13
Huntington	St. Louis Samp. & Test. Co.	1.33	77.83	15.21	...	7.09
Huntington	R. R. Gazette, 1/3/99	1.99	72.87	17.27	2.69	5.18
Jenny Lind	St. Louis Samp. & Test. Co.	0.94	76.73	13.64	1.57	7.12
Jenny Lind	W. B. Snow	1.26	72.48	17.64	2.11	8.62
Eureka	St. Louis Samp. & Test. Co.	1.22	75.64	9.44	3.36	10.14

California.

Black Diamond	Mineral Res. U. S.	13.15	34.235	42.15	...	10.60
Livermore	Mineral Res. U. S.	16.00	34.00	41.75	...	8.25
Shasta	Mineral Res. U. S.	9.50	46.25	37.50	...	6.75
Eel River	Mineral Res. U. S.	8.14	38.67	45.54	...	7.66

Colorado.

Lenox	William Kent	2.92	45.36	41.18	1.39	10.54
Rouse	Min. Res. U. S.	2.48	50.78	36.29	0.72	10.45
Huerfano Seam	Min. Res. U. S.	6.74	49.70	36.36	0.64	7.20
Crested Buttes	Min. Res. U. S.	0.72	71.91	23.44	0.36	3.93
Victor	William Kent	1.26	53.10	36.40	1.11	9.24
Sopris	Min. Res. U. S.	0.40	57.80	30.30	0.59	11.50
El Moro	John Fulton	0.95	56.41	29.82	0.41	12.82
Porter	William Kent	0.63	57.30	34.70	0.74	7.37

and sulphur, but one contained only 3 per cent. ash and clinkered badly, while the other coal, with 7 per cent. ash, gave practically no clinker. Evidently, as reported by the chemist in this case, in the latter coal the fusible or clinker-forming material was diluted with the larger amount of ash and rendered inert.

An ultimate analysis is more elaborate, more difficult to make and more costly than the proximate. It gives the elementary constituents of coal as follows: carbon; hydrogen; oxygen; nitrogen; sulphur; ash. From this analysis the total heating power of the coal may be quite accurately calculated by the use of Dulong's formula, as follows:

Heating power $= 14{,}500\ C + 62{,}100\left(H - \frac{0}{8}\right)$.

Or, as used by Prof. Lord

Heating power $= 8{,}080\ C + 34{,}462\left(H - \frac{1}{8}\ 0\right) + 2{,}250\ S$.

in which

14,500 = heat of combustion of carbon in B. T. U.

8,080 = heat of combustion of carbon in calories.

62,100 = heat of combustion of hydrogen in B. T. U.

34,462 = heat of combustion of hydrogen in calories.

$H - \frac{0}{8}$ = the amount of hydrogen less that supposed to form water with the oxygen.

2,250 = heating power of sulphur in calories.

The heating power of coal calculated from ultimate analyses by use of the above will vary but little from its actual value as determined by a calorimeter test, provided the analysis is an accurate one.

In the experiments of Profs. Lord and Haas on the calorific value of certain American coals, which are probably the most accurate and elaborate ever made in this country, it was found that the maximum difference in heating values between those calculated from analyses and those obtained by actual calorimeter tests was 2.0 per cent. and the minimum 0.1 per cent.

Calorimeter Tests.—Under the subject of coal analyses may properly be considered the determination of the heating value of coals by the use of the calorimeter. The calorimeter is an instrument used for the purpose of determining the actual calorific value of any coal, whatever its nature. It usually consists of a combustion chamber and a bath of water surrounding it, the temperature of which can be measured. The combustion takes place in oxygen.

There are several different kinds of calorimeters, but the only type that will always give accurate results, when properly handled, is the "bomb" calorimeter, Mahler's being the most used and giving the most accurate results. An improved form of bomb calorimeter similar to the Mahler, but made with the view of remedying the defects of the latter, has been made by Mr. H. J. Williams. This calorimeter is generally considered to be the best now in use in this country. The Barr calorimeter, used largely by railroads, is reported as giving too low results when compared with the Mahler and Williams calorimeters, the difference being about 500 units as reported by the West Virginia Geological Survey. The calorimeter test gives the number of heat units contained in a pound of coal and, taken with the analysis, will give the true value of the coal and also show how the coal will act when used.

The following table, taken from a paper on "The Valuation of Coals" presented by

Name of Coal.	Authority.	H_2O.	Fixed Carbon.	Volatile Matter.	Sulphur.	Ash
Georgia.						
Dade County	William Kent	1.20	60.50	23.05	0.84	15.16
Illinois.						
Big Muddy	Peabody and Miller	5.79	55.79	30.11	1.03	8.31
Big Muddy	Engrs. Club, of St. Louis	7.39	53.87	28.28	0.98	10.36
Collinsville (Av. 4)	Engrs. Club, of St. Louis	9.20	45.89	31.57	5.34	13.34
Du Quoin	Engrs. Club, of St. Louis	11.3	49.9	30.3	0.90	8.50
Danville	Min. Res. U. S.	9.60	44.56	31.20	...	14.64
Gillespie	W. B. Snow	12.61	45.27	30.58	1.45	11.54
Mt. Olive	W. B. Snow	10.38	46.10	36.68	3.53	6.84
Wilmington Lump	William Kent	15.5	39.9	32.8	...	11.8
Wilmington Screenings	William Kent	14.0	34.2	28.0	...	23.8
Wilm'ton Screen'gs Washed	William Kent	14.5	42.9	29.5	...	13.1
Mt. Carbon	John Fulton	2.08	53.47	38.20	3.66	5.14
Steator (Av. 5)	William Kent	9.9	42.2	33.2	...	14.6
Girard	W. B. Snow	8.90	42.89	32.25	8.10	15.96
Indiana.						
Brazil Block	Poole	8.98	50.30	34.49	1.39	6.28
New Pittsburg	Poole	5.89	40.40	42.23	5.88	11.48
Lorimer	N. W. Lord	8.70	43.70	43.10	1.86	4.50
Indian Territory.						
Alderson	U. S. Navy Reports	2.30	57.34	33.36	0.21	7.00
McAllister	William Kent	1.80	53.40	37.17	0.90	6.73
McAllister	R. R. Gazette 1/3/99	4.00	53.00	34.00	1.50	7.50
Lehigh	William Kent	4.32	48.47	40.51	2.60	8.10
Choctaw	William Kent	1.59	66.85	23.31	1.18	8.25
Atoka	W. B. Snow	6.66	51.32	35.42	3.73	6.60
Kansas.						
Pittsburg No. 3	R. R. Gazette, 1/3/99	2.30	53.08	34.97	4.97	9.65
Litchfield	R. R. Gazette, 1/3/99	1.29	53.97	35.72	5.00	9.02
Leavenworth	R. R. Gazette, 1/3/99	6.70	52.74	33.18	3.09	7.38
Weir	R. R. Gazette, 1/3/99	8.91	53.38	25.14	1.76	12.57
Kentucky.						
Peach Orchard (Av. 2)	U. S. Govt. Reports	4.60	53.28	35.70	1.08	6.42
Vanderpool	U. S. Govt. Reports	4.00	54.60	34.10	...	7.30
Manchester	W. B. Snow	1.20	60.70	38.10	1.793	5.80
Providence	U. S. Navy Reports	4.04	56.74	32.40	0.807	6.76
Hawesville	W. B. Snow	3.30	50.50	39.00	3.373	7.20
McHenry	U. S. Govt. Reports	3.24	54.95	36.56	1.19	5.24
Maryland.						
Cumberland	Md. Geol. Survey	1.23	73.51	15.47	0.70	9.09
Cumberland	U. S. Navy Reports	0.99	74.87	16.81	0.14	7.32
Cumberland		0.69	70.701	18.29	0.934	9.96
Georges Creek	Peabody and Miller	0.59	74.31	18.52	0.81	6.58
Georges Creek	A. S. McCreath	0.96	72.71	19.14	0.79	6.41
Georges Creek	Proc. A. S. M. E.	0.94	73.15	18.40	0.80	6.69
Georges Creek	U. S. Navy Reports	1.08	75.954	17.31	0.25	5.41
Michigan.						
Saginaw	Wickes Boiler Co.	...	50.73	37.895	0.99	3.77
Standard	Wickes Boiler Co.	10.67	53.80	33.59	0.93	1.94
Pere Marquette	Wickes Boiler Co.	10.15	53.95	31.14	1.11	2.76
St. Charles	Wickes Boiler Co.	7.79	52.58	34.74	0.82	4.98
Missouri.						
Marcelline	R R. Gazette 3/13/99	11.00	48.65	33.42	3.98	6.93
Ardmore	R R. Gazette 3/13/99	3.69	51.31	41.24	1.14	3.76
Bevier	R R. Gazette 3/13/99	4.39	52.50	36.66	1.80	6.45
Rich Hill	W. B. Snow	2.54	41.14	42.62	...	13.70
Montana.						
Sand Coulee	John Fulton	2.26	54.47	33.60	1.85	7.82
Belt Mountain	John Fulton	2.98	53.31	28.71	1.65	13.34
Bridger Lump	Proc. Mont. Engrs., 1902	7.67	54.00	26.55	...	11.78
Red Lodge	Proc. Mont. Engrs., 1902	9.23	52.39	26.24	...	12.14
Ohio.						
Briar Hill	C. W. Houghton	4.80	56.30	34.60	...	4.30
Pittsburg Seam	Greene Eng. Co.	1.58	53.48	37.85	1.51	7.09
Saline ville	N. W. Lord	2.80	52.80	36.30	3.00	8.10
Cambridge	N. W. Lord	2.43	50.36	37.79	3.01	9.42
Hocking (Av. 10)	Proc. A. S. M. E.	6.95	51.30	36.15	0.66	5.66
Hocking (Av. 10)	Lord & Haas	6.65	49.54	34.14	1.67	9.67
Hocking (Av. 10)	William Kent	6.59	48.85	34.97	1.59	8.00
Hocking (Av. 10)	Geol. Surv. O.	5.00	53.15	37.80	0.44	9.05
Jackson (Av.)	Lord & Haas	8.17	52.78	35.79	1.13	3.25
Steubenville	Lord & Haas	2.40	49.30	39.20	3.00	9.10
Palestine	Lord & Hass	1.65	51.32	37.45	1.75	9.58
Yellow Creek	Lord & Haas	1.23	50.88	38.72	3.89	9.17
Wellston (Av. 18)	Greene Eng. Co.	6.96	52.63	34.68	0.89	5.73
Oregon.						
Coos Bay	William Kent	15.45	34.95	41.55	2.53	8.05
Pennsylvania.						
Turtle Creek	Lord & Haas	1.75	53.00	36.20	1.66	9.05
Ocean	U. S. Navy Reports	1.58	62.26	29.96	0.22	8.20
Carnegie	Lord & Haas	1.08	52.00	37.67	2.54	9.25
N. Mansfield	Lord & Haas	2.10	52.65	36.20	1.77	9.05
Loyal Hanna	U. S. Navy Reports	0.70	65.838	24.387	1.28	7.886
Irwin	William Kent	1.41	54.44	37.66	0.64	5.86
Greensburg	J. K. Adams	1.1	57.88	34.9	1.52	4.60
Youghiogheny	W. B. Snow	2.02	58.96	32.14	0.88	6.88
Youghiogheny screenings	R. C. Carpenter	1.77	56.10	31.34	...	10.79
Pittsburg	A. S. McCreath	1.43	55.89	36.14	0.94	5.59
Pittsburg	William Kent	1.37	52.21	35.90	1.80	8.02
Pittsburg	Peabody and Miller	1.36	59.14	32.00	1.26	7.50
Connellsville	A. S. McCreath	1.26	59.62	30.11	0.784	8.23
Connellsville	Peabody and Miller	0.94	64.06	27.39	1.07	7.61
Connellsville	John Fulton	1.26	59.79	31.80	0.53	7.16
Reynoldsville	Barrus and Dean	0.45	59.46	32.63	1.07	7.46
Reynoldsville	Min. Res. U. S., 1895	0.983	60.96	30.933	1.06	6.105
Reynoldsville	U. S. Navy Reports	1.14	61.92	28.40	1.96	8.54
Reynoldsville	A. S. McCreath	1.11	55.80	36.02	2.593	4.47
Eureka	U. S. Navy Reports	0.48	71.632	21.61	1.96	4.324
Eureka	Peabody and Miller	0.44	73.15	18.76	1.02	7.65
Clearfield	A. S. McCreath	1.186	69.27	23.17	0.933	6.44
Pardee	U. S. Navy Reports	0.606	74.165	15.24	0.693	9.29
Morrisdale	U. S. Navy Reports	0.83	70.036	18.98	1.416	8.729
Powellton	Mills & Rowan	0.60	68.709	22.60	2.691	5.40
Moshannon	U. S. Navy Reports	0.43	67.968	23.261	1.09	7.251
Summerhill	Professor Gale	2.46	69.37	20.52	1.50	9.15
Bennington	John Fulton	1.20	68.77	23.68	0.62	5.73
Johnston	John Fulton	0.72	73.84	16.49	1.97	7.97
South Fork	Mills & Rowan	1.10	73.145	17.24	2.352	6.163

Name of Coal.	Authority.	H_2O.	Fixed Carbon.	Volatile Matter.	Sulphur.	Ash
Pennsylvania.						
Broad Top	John Fulton	1.28	71.12	18.40	1.70	7.50
Antrim	Hawley Furnace Co.	1.46	65.12	21.60	2.82	9.00
Fall Brook No. 2	A. Hardt	0.45	69.67	19.40	0.31	10.48
Morris Run	John Fulton	0.160	70.78	19.12	0.731	8.91
Bloss	A. Hardt	1.06	73.79	18.88	0.69	6.27
Tennessee.						
Coal Creek	Hawley Furnace Co	...	58.80	34.20	0.79	6.93
Aetna	Tenn. Geol. Survey	0.94	63.94	23.72	1.19	11.40
Roane	Min. Res. U. S.	1.750	60.110	26.62	1.049	11.520
Glen Mary	W. B. Snow	2.15	61.63	31.47	0.94	4.75
Suwanee	William Kent	1.60	61.00	29.30	...	7.80
Texas.						
Eagle Pass	J. Fulton	5.27	44.46	37.48	2.57	10.22
Ft. Worth	W. B. Snow	14.42	42.53	30.03	1.47	13.02
Thurber	U. S. Navy	3.35	49.43	35.15	0.639	12.07
Utah.						
Pleasant Valley	H. B. Hodges	5.40	44.06	44.66	0.79	5.88
Pleasant Valley	H. B. Hodges	6.02	47.84	47.94	0.69	3.20
Scofield	H. B. Hodges	5.20	46.00	44.96	1.06	3.84
Castle Gate	U. S. Navy	2.30	48.63	37.91	0.20	9.36
Virginia.						
Looney Creek	A. S. McCreath	1.40	58.365	33.660	0.705	5.87
Big Stone Gap	U. S. Geol. Survey	1.40	59.15	33.85	1.14	4.99
Tom's Creek	A. S. McCreath	0.86	57.37	34.88	0.90	5.66
Tom's Creek	St. Louis S. & T. Co.	2.22	59.66	29.56	0.56	8.56
Washington.						
Roslyn	Stirling Boiler Co.	2.42	56.69	27.37	0.16	13.36
Franklin	U. S. Navy Reports.	3.66	50.78	34.63	...	10.93
Skagit Cumb.	U. S. Navy Reports.	0.25	77.41	7.46	0.22	14.88
Black Diamond	U. S. Navy Reports.	3.11	45.11	47.19	...	4.58
Wyoming.						
Lignite	Peabody and Miller	5.75	47.63	39.98	0.21	6.64
Rock Springs	U. S. Navy Reports.	6.65	53.27	35.79	0.399	4.29
Glen Rock	W. B. Snow	10.20	51.11	34.40	...	5.29
Sheridan	W. H. Williams.	21.20	46.40	26.78	...	5.62
West Virginia.						
Elk Garden	U. S. Navy Reports.	1.059	71.287	21.963	1.47	5.54
Elk Garden	U. S. Geol. Survey	0.76	72.99	19.39	0.88	6.86
Elk Garden	W. Va. Survey	0.46	71.23	21.11	0.43	7.20
Fairmont (Av. 51)	W. Va. Survey	1.43	53.83	37.47	2.59	7.27
Kanawha, Coalburg	W. Va. Survey	0.56	56.38	36.63	0.51	6.43
Campbell's Creek	W. Va. Survey	1.12	55.05	36.63	1.16	7.20
Kanawha Splint	W. Va. Survey	0.41	57.36	34.13	1.07	8.10
Winifrede	W. Va. Survey	1.07	55.69	35.79	0.77	6.45
Junior	W. Va. Survey	0.81	61.98	28.73	1.07	8.48
Funnelton	W. Va. Survey	0.62	57.66	31.00	3.41	10.72
New River	Peabody and Miller	0.77	72.69	21.70	0.77	4.84
New River	U. S. Navy Reports.	1.02	71.054	19.86	0.275	7.976
New River	U. S. Navy Reports (Hohenstein test)	0.49	72.99	21.79	0.46	4.73
New River	Barrus and Denton, "Power," 1901	1.09	70.26	23.75	1.07	4.90
Thacker	Lord and Haas	1.38	56.67	35.68	1.28	6.27
Tug River	U. S. Navy Reports.	0.80	74.90	17.17	0.295	7.13
Poca (Av. 14)	U. S. Navy Reports.	1.25	78.94	14.93	0.26	4.14
Poca (Av. 14)	U. S. Navy Reports (Hohenstein test)	0.79	75.78	19.53	0.71	3.90
Poca (Av. 14)	Peabody and Miller	0.54	77.28	16.70	0.79	5.48
Poca (Av. 14)	Proc. A. S. M. E.	1.20	76.15	18.45	0.60	4.00
Poca (Av. 14)	Lord and Hass.	0.76	74.84	18.51	0.59	5.89

ULTIMATE ANALYSES.

Name of Coal.	Authority.	C.	H.	O.	N.	S.	Ash.	H_2O.
Georges Creek, Md.	Peabody and Miller	81.05	4.91	4.57	2.15	0.70	6.62	0.59
Brazil, Ind.	Poole	70.50	4.76	16.29	1.36	1.39	6.28	8.98
Big Muddy, Ill.	Peabody and Miller	71.81	4.85	11.52	2.04	0.96	8.82	5.79
Jackson, O.	Lord and Haas	70.05	5.43	17.09	1.49	1.84	4.10	8.26
Hocking, O.	Lord and Haas	66.50	5.16	15.57	1.43	1.67	9.67	6.65
Clearfield, Pa.	Peabody and Miller	80.17	5.08	4.69	1.46	0.91	7.69	0.44
Pittsburg, Pa.	Peabody and Miller	76.47	5.19	8.10	1.45	1.19	7.60	1.36
Pittsburg, Pa.	Lord and Haas	75.24	5.18	8.24	1.51	1.79	8.02	1.37
Thacker, W. Va.	Lord and Haas	78.90	5.14	6.88	1.42	1.16	6.50	1.40
New River, W. Va.	Peabody and Miller	83.57	4.69	4.51	1.63	0.72	4.88	0.77
New River, W. Va.	Barrus, Dean and Main, 1901.	83.84	4.72	3.77	1.65	1.07	4.95	1.09
New River, W. Va.	U. S. Navy (Hohenstein test)	83.60	4.85	4.87	1.41	0.46	4.81	0.49
Pocahontas, W. Va.	U. S. Navy (Hohenstein test)	84.96	4.07	5.46	0.90	0.71	3.90	0.79
Pocahontas, W. Va.	Proc. A. S. M. E., 1903.	87.39	4.27	2.87	0.87	0.60	4.00	1.20
Pocahontas, W. Va.	Lord and Haas.	85.40	4.39	3.94	0.85	0.62	4.80	0.85

CALORIMETER TESTS.

Name of Coal.	Authority.	B. T. U. Per Lb. Coal.	B. T. U. Per Lb. Combustible.
Huntington, Ark.	Proc. A. S. M. E., 1899.	12935	.....
Tom's Creek, Va.	H. J. Williams.	13873	.....
Glen Mary, Tenn.	W. B. Snow.	13167	.....
Jellico, Tenn.	J. W. Hill.	13846	14299
Georges Creek, Md.	G. H. Barrus.	14217	15140
Wellston, O.	J. W. Hill.	12506	14080
Cambridge, O.	Lord & Haas.	12658	14578
Jackson, O.	Lord & Haas.	12515	14270
Jackson, O.	G. H. Barrus.	12139	12832
Hocking, O. (R. O. M.)	Lord & Haas.	11695	13972
Hocking, O., Lump.	Lord & Haas.	12388	14166
Streator, Ill.	W. B. Snow.	11403	.....
Big Muddy, Ill.	W. B. Snow.	11781	.....
Reynoldsville, Pa.	W. B. Snow.	12981	.....
Reynoldsville, Pa.	Barrus & Dean.	14342	15372
Eureka, Pa.	G. H. Barrus.	13640	.....
Eureka, Pa.	G. H. Barrus.	13043	.....
Sonman, Pa.	G. H. Barrus.	13326	.....
Pittsburg, Pa.	Lord & Haas.	13557	.....
Pittsburg, Pa.	R. C. Carpenter.	13025	14895
Pittsburg, Y'g'y.	G. H. Barrus.	13493	14603
Elk Garden, W. Va.	G. H. Barrus.	13180	14295
Thacker, W. Va.	Lord & Haas.	14071	15376
New River (Av. 8)	G. H. Barrus.	14081	14779
New River	William Kent	14631	15320
New River	Barrus & Dean.	14934	15696
Pocahontas	William Kent	15070	15700
Pocahontas (Av. 5)	Lord & Haas.	14589	15829
Pocahontas (Av. 10)	G. H. Barrus.	14084	14926
Pocahontas (Av. 5)	Proc. A. S. M. E., 1903.	15186	15772
Pocahontas (Av. 2)	B. & W. Boiler Co.	15779	.....

Prof. Lord before the American Association for the Advancement of Science in 1898 shows the comparatively close correspondence between the results obtained by calorimeter trials and those actually obtained under boilers. It also shows that a semi-bituminous coal, "like Pocahontas, high in carbon and low in hydrogen, gives higher evaporative duty in proportion to its calorimeter value than those coals higher in hydrogen and oxygen, as was, of course, to be expected."

Relative Values of Coals (Hocking Coal = 100.)

Coal.	By Calorimeter.	Boiler Test.	Calculated Evaporation.
Hocking	100	100	100
Pocahontas	122	127	131
Thacker	116	117	116
Freeport	109	106	109
Darlington	112	105	109
Pittsburg	113	113	114

Analysis of Ash.—Where still further knowledge of a coal is desired, an analysis of the ash should be made. It is possible to determine from such an analysis to what degree the ash is fusible, what kind of clinkers will be formed and their nature—i.e., whether the clinker will be such that it will not stick to the grate bars and may be easily removed or whether it will adhere closely to the grates and run down through the air spaces.

Typical analyses of ash are given below, together with analyses of the coals which gave the ash.

No. 1 Coal.	Per Cent.	No. 1 Ash and Clinker.	Per Cent.
Water	0.496	Silica	34.80
Fixed carbon	73.53	Alumina	23.30
Volatile matter	19.139	Oxide of iron	11.64
Sulphur	0.475	Carbonate of lime	23.50
Ash	6.360	Magnesia	3.65
		Undetermined	3.11

This coal made a readily fusible ash, and the clinker formed covered the grates with a thin, reddish black, glassy coating. It stuck closely to the grates and ran down through the air spaces, with thin black hangers extending from grate to ashpit. The fusibility is explained by the large percentage of iron, lime and magnesia.

No. 2 Coal.	Per Cent.	No. 2 Ash.	Per Cent.
Water	0.39	Silica	23.23
Fixed carbon	62.24	Alumina	23.79
Volatile matter	25.29	Carbonate of lime	10.76
Sulphur	1.17	Magnesia	5.38
Ash	10.08	Oxide of iron	28.33

This coal made a very thick, heavy, reddish brown clinker, with black knobs, which was formed so quickly that on a locomotive test, with a light passenger train, the fire had to be cleaned every 25 miles. It would be hard to find a worse ash than this.

No. 3 Reynoldsville Coal.	Per Cent.	No. 3, Ash.	Per Cent.
Water	...	Silica	40.32
Fixed carbon	58.07	Alumina	39.02
Volatile matter	33.00	Oxide of iron	17.81
Sulphur	2.28	Lime	2.65
Ash	8.93	Magnesia	0.7
		Sulphur trioxide	0.46

It has been often stated that if the ashes and clinkers formed from any coal were of a reddish color it showed the presence of a large percentage of iron and, therefore, that such coal would clinker badly and was inferior to coals with a white ash. This statement is misleading. At least two of the best semi-bituminous coals in this country, as well as some of the best Welsh coals, give reddish brown ashes or clinkers, whereas some of the very poorest coals, from an economical standpoint, give a white ash. Of much more importance than the color of the ashes or clinkers is their quality—that is, whether the clinker will stick to the grates and furnace walls and be difficult to remove, or whether it may be easily pulled out by the fireman. Some coals will make a clinker that has to be chipped off the grates with hammer and chisel after the fire is out. Such clinker is usually thin, but entirely covers the grates. Other coals may make

much more clinker in quantity, but it will not be much trouble to get it out of the furnace.

It will be readily seen, then, of what practical value to the buyer of coal correct and accurate analyses of coal may be. The cost of such analyses is very small when their ultimate value is considered. In the opinion of the writer, the time is coming when many large contracts for coal will be based on the average value as shown by analyses, especially on the percentage of fixed carbon, sulphur and ash.

If this view is correct, it would seem to be the wisest policy on the part of the coal operators to see that their coal is properly prepared and their standards maintained. The maintenance of a certain standard analysis for any coal is to a certain extent now (and it will be still more so in the future), a very important factor in increasing and keeping up the output and sales of such coal.

Below will be found both proximate and ultimate analyses of various coals from different parts of the United States, together with results of some calorimeter tests.

Tensile Impact Tests of Metals.*

The author has investigated the relative behavior of materials under impact and gradual loading in tension. A vertical tensional impact testing machine was construct-

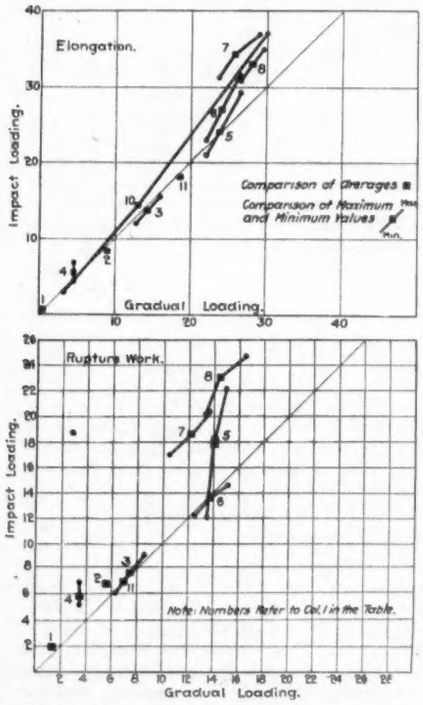


Fig. 1—Comparison of Per Cent. of Elongation and Unit Rupture Work under Gradual and Impact Loading in 100 Ft.-Lb. Units.

ed in 1897 and since that year experiments have been carried on in the laboratory for testing materials of Purdue University. The results lead to the conclusion that the ductility and shock-resisting capacity of metals of normal quality are not less under impact loading than those disclosed by the static test.

The paper includes description of machines and methods; comparison of static and impact tests; effect of gage length; effect of number of blows; effect of speed of delivery of energy; effect of temperature; effect of condition of surface. There are 15 tables and 15 figures in the paper, giving full details of the tests.

Definitions: The term "rupture-work" is taken to mean the work done in deforming a body to rupture. The area between the ordinary stress-strain diagram and the axis of deformation is a measure of this rupture-work. The latter term has often been replaced by the term "total resilience." Strictly speaking, the term "resilience" refers to the elastic energy stored up in a body at any stage of deformation. "Unit rupture-work" is the rupture-work per unit of volume. Thus if a bar of steel ½ in. in diameter and 8 in. long is ruptured in tension as the result of a blow of a 512-lb. hammer falling from five feet, thereby bringing the hammer to rest, the total rupture-work will be 2,560 foot-pounds, and the unit rupture-work will be 1,630 foot-pounds per cubic inch of metal.

The Impact Machines: Two different machines, both vertical, have been used in these tests. For the tests on the specimens of steel wire 9 ft. long (Nos. 1 to 4 in the table) a temporary wooden machine was constructed. This apparatus for producing longitudinal impact in tension was modeled after an apparatus used at Cornell University by Mr. Charles W. Comstock in impact tests of steel wire-rope during 1898.† The principle therein employed, by which the hammer is hung on the specimen and impact is effected by sudden arrestment, during the fall, of an upper moving head, also fixed to the specimen, has been used in France in certain foundries.

The writer improved this form of apparatus by supplying a rotating drum, upon the surface of which a pencil, attached to the hammer, records a curve during the impact. The vertical ordinates to this curve, called a "velocity-displacement curve," are the movements of the hammer; and the horizontal abscissæ are proportional to the speed of the surface of the drum. The latter speed is known from the record of a vibrating tuning fork, held against the drum. The velocity of the hammer may be computed from the drum record at any stage of descent.

In operation, the system, consisting of hammer, specimen, and upper head, is raised. Upon release, and subsequent descent, the upper head has impact upon a stop on bridge, and the energy of the moving hammer thereby ruptures the test specimen. The pencil attached to the hammer is automatically released before the impact occurs, and the above mentioned record is thereby written on the surface of the drum. The energy remaining in the hammer after the rupture of the test bar is computed from a measurement of the velocity of the hammer at the time of rupture. This latter velocity is obtained from the slope of a tangent in the

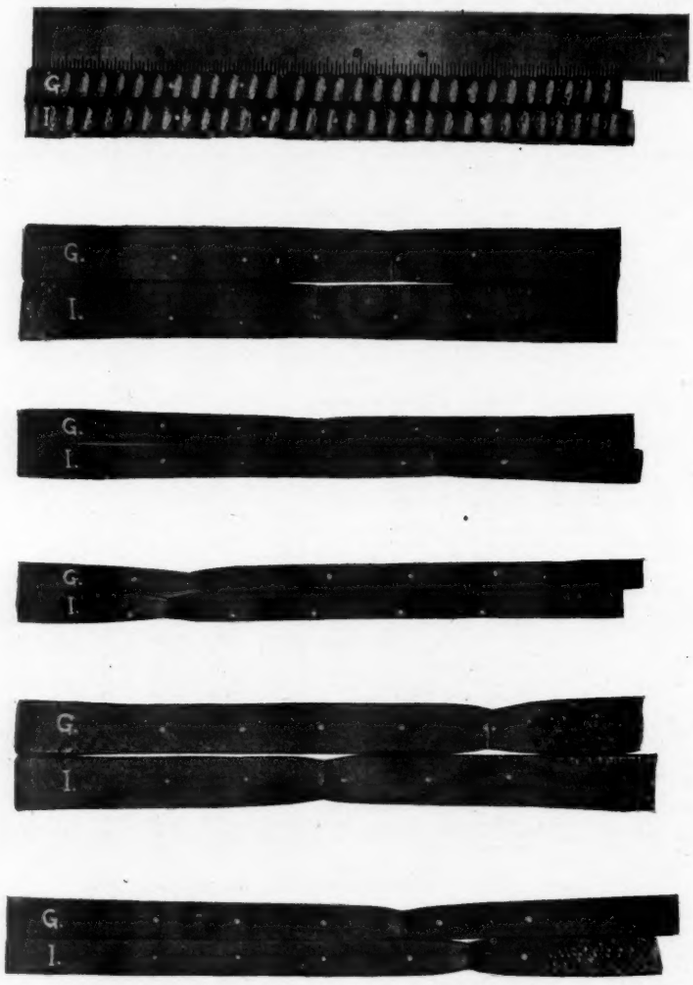


Fig. 2—Bars Broken by Impact and Gradual Loading.

Lower bar of each pair broken in .01 second. Upper bar broken in about 10 minutes.

*Abstract of a paper by W. Kendrick Hatt, read at the Atlantic City meeting of the American Society for Testing Materials.

†Trans. Cornell Soc. C. E., Vol. 189.

velocity-displacement curve. The weight of the hammer varied from 845 to 1,230 lbs., and the greatest length of fall was 7 ft.

The experiments performed on this temporary apparatus include the following: (1) A series of comparative tests of long steel and iron rods under slow and impact-loading —1898. (2) A series of tests of steel wire of different lengths, and the determination of the effect of temperature on tests of wrought iron—1899.

In the accompanying table the material under the reference numbers 1, 2, 3, 4 and 10 was tested on this temporary apparatus. The experiments performed on the temporary apparatus were successful enough to encourage the construction of a more permanent machine in metal. This machine has been described elsewhere in detail.‡ The weight of the hammer varied from 515 to 870 lbs., and the greatest height of fall was 6 ft.

In the paper there is a mathematical discussion of the principle of the action of these machines, and of the energy lost in the parts of the machines. The work performed with the aid of this machine includes the following: Tests of nickel steel and soft carbon steel in tension under gradual and impact loading; effect of speed of application of a given amount of energy; effect of temperature on the resilience of soft and nickel steel—1900; tests of steel castings in tension and flexure; tests of cast iron in flexure; tests of concrete under impact and compression—1901.

Comparison of Impact and Static Tests: One of the first matters of interest to an investigator is the relative behavior of material under impact and slow loading. It is also important to know how far the ordinary static test will yield information of the relative shock-resisting capacity of various metals. In the table is a tabulation of results of such comparative tests.

It appears from the results given that in the case of normal soft material in bars of circular cross section of lengths from 9 ft. to 8 in., tested at ordinary temperatures, there is little difference in the total elongation and unit rupture-work whether the bar is ruptured in ten minutes or in from one to two-hundredths of a second. The only marked point of difference in the static and impact tension test of soft materials of greater lengths is that any lack of homogeneity of material is brought more into evidence in the latter species of test. There is a tendency in non-homogeneous materials under impact to localization of the elongation of a test bar at various points in the gage length, so that the latter consists of nodes of ductility. After rupture the bar may have a number of incipient necks. In many cases two distinct necks are formed. The effect may be noticed in static tension tests, but not, in the author's experience, to the same degree as in impact tests. There is also a tendency under impact to localization of elongation near the wedges.

A marked difference between the results of gradual impact tests may be noticed in case of short bars of steel castings and tire steel and coupons from boiler plate. There is a greater elongation and unit rupture-work under impact in the case of soft steel castings. But in the case of the harder steel, like tire steel, the increase in unit rupture-work is disproportionate to the increase in elongation. This is partly due to the fact that there is considerable metal between the gage marks and the wedges in these steel castings, whereas the unit rupture-work is computed on the basis of the volume within gage-marks.

The tests cover a range of soft steel castings to hard tire steel, and a range of gage length from 2 in. to 9 ft. All comparisons, however, made between static and impact tests of any one material are based on bars of the same gage length for the two kinds of tests, and represent tests in which the bars were broken in one blow, except as where noted. The table shows the quality of the material and the average, as well as the maximum and minimum values observed.

The comparison of the two kinds of tests is graphically shown in Fig. 1, in which both axes are equal scales of the same kinds of quantity. If there were no effect of speed the plotted points would lie on the 45 deg. line drawn on Fig. 1. The comparison of averages is plotted as a point, and also the comparison of the maximum values and the comparison of the minimum values. The elongation is always that obtained by measurements on the broken ends of the test bars. The rupture-work for the gradual tests was worked up from observations taken on specimens. In the case of long rods and very short rods this was done by direct measurement, and in the case of specimens of 8-in. gage length the rupture-work was obtained by the use of the Henning pocket recorder. An exception must be made in the case of tire steel.

In the case of long rods there was a noticeable difference between the elongation of the rods as shown on the drum record and the elongation as determined by laying the broken ends of the specimen together and measuring the increase of length between the gage marks. The difference is no doubt due to the elastic strength at rupture and subsequent recoil upon the breaking of the bar.

Information is given in the paper more in detail concerning the properties of steel castings and locomotive tire steel under impact.

A photograph of bars of various metals is given in Fig. 2, one of each pair of which was ruptured under impact, and the other under gradual loading.

Effect of Change of Temperature of Test Bar: To determine the law controlling the variation of resistance in change of temperature under impact, the writer used specimens of soft steel and nickel steel (Nos. 5 and 6 in the table). The results of this investigation are shown in Figs. 3 and 4. It appears from these results that in the case of ordinary soft steel there is a diminution of elongation and unit rupture-work as the

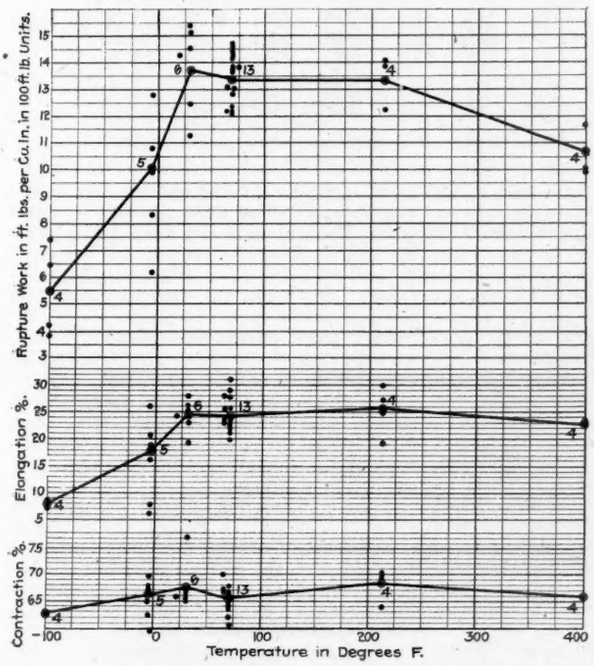


Fig. 3—Effect of Temperature on Soft Steel under Tensional Impact Loading.

½ in. in diameter, 8 in. long, one blow.

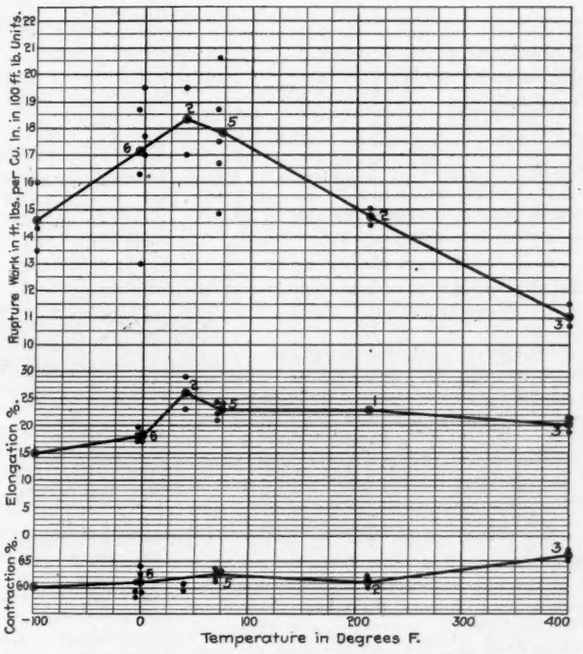


Fig. 4—Effect of Temperature on Nickel Steel under Tensional Impact Loading.

½ in. in diameter, 8 in. long, one blow.

‡Nouveaux Appareils d'essai-Congres. Intern. des Meth. d'essai, Paris, 1900. Vol. I., p. 507, or *Eng. News*, Jan. 4, 1901.

temperature goes below 32 deg. F. or above 212 deg. F. In the case of nickel steel this diminution is apparent when the temperature goes below 32 deg. or above 70 deg. The contraction seems not to be much affected by change of temperature. Even in case the bars cooled to (—) 100 deg. F. the fracture was so hot that the broken end of the bar felt uncomfortably hot.

SHOWING COMPARATIVE TESTS UNDER GRADUAL AND IMPACT LOADING IN TENSION.

Except where noted impact tests were made with one blow at atmospheric temperature on test bars of the same length as used in gradual tests. Elongation is that after rupture. Rupture work is that up to rupture.

Number.	Material.	Diameter, in.	Gage length, in.	Ultimate strength lbs. per sq. in.	No. Tested.	Elongation per cent. Maximum.	Elongation per cent. Minimum.	Elongation per cent. Average.	Rupture work, ft. lbs. per cu. in. Maximum.	Rupture work, ft. lbs. per cu. in. Minimum.	Rupture work, ft. lbs. per cu. in. Average.	Kind of Test.
1.	Steel wire	0.16	48	115,000	2	0.71	0.48	0.59	144	130	136	Gradual
		...	108	.....	4	1.00	0.42	0.70	208	165	186	Impact
2.	Steel wire annealed	0.16	48	83,000	1	...	..	9.30	...	...	566	Gradual
		...	108	.....	5	11.0	8.7	9.8	803	648	772	Impact
		...	48	.....	2	8.0	6.0	7.0	534	534	544	Impact
3.	Steel wire	0.30	72	71,800	5	15.8	12.8	14.1	865	690	742	Gradual
		...	108	.....	6	15.6	12.0	13.6	903	515	765	Impact
4.	Steel wire	0.26	108	109,000	2	4.64	4.62	4.63	349	347	348	Gradual
		...	108	.....	15	7.0	4.0	5.10	699	443	556	Impact
		...	69	.....	5	7.0	5.0	5.80	673	596	626	Impact
5.	Nickel steel	0.50	8	85,000	6	26.7	22.1	23.6	1505	1360	1414	Gradual
		...	8	.....	8	29.4	20.7	24.0	2216	1203	1821	Impact
6.	Soft steel	0.50	8	68,000	7	26.3	21.9	23.9	1532	1260	1376	Gradual
		...	8	.....	13	31.6	23.1	27.0	1460	1208	1358	Impact
7.	Boiler plate steel	1.0	8	60,000	19	29.0	23.2	25.7	1370	1047	1230	Gradual
		0.5	8	.....	4	36.9	31.3	34.4	2035	1690	1855	Impact (2 blows)
8.	Soft steel castings	0.5	2	62.000	5	29,5	26.5	28.2	1666	1342	1450	Gradual
9.	Hard steel castings	...	..	82,000	..	...	31.0	33.0	2467	2080	2315	Impact
		...	...	.....	..	...	...	...	....	....	.....	.....
		...	...	.....	5	35.0	...	...	....	....	.....	.....
10.	Locomotive tire steel	0.62	3	140,000	30	30.0	3.0	13.1	2000	212	976	Gradual
		...	..	60,000	30	37.0	3.0	14.3	5650	890	2918	Impact
11.	Norway iron	0.305	72	63,000	1	...	...	18.7	....	....	649	Gradual
		...	108	.....	3	19.4	16.7	18.1	727	550	656	Impact

Ideal Blacksmith Shop and Equipment for General Railroad Work.*

We think the ideal blacksmith shop of today is the one built of structural iron encased in brick, the roof of which has been given due consideration, leaving a large factor of safety after the jarring from the large steam hammers and the support of the masts of the necessary jib cranes carrying from four to five tons each while working under a steam hammer has been satisfied. The altitude of the eaves from the floor line should be about 30 feet. The roof should be of the monitor design, with pivoted windows at each end and the sides. The three-sash windows in the walls are preferred, bottom sash to hoist and top sash pivoted; thus inviting a good current of air in the shop. The accommodations of ventilation and light should be at least 60 per cent.

The first consideration as to the necessary dimensions should be that of forges; the design and number necessary and the number of square feet of floor space required for the same. We think double forges preferable and most economical in floor space when placed on an angle of 45 deg., with 15 ft. from the wall to the center of the stack and 15 ft. from center to center of stacks, allowing 20 ft. from center of stack toward center of shop for working room. Two forges and their working room will occupy 525 sq. ft. of floor space, and placed at an angle of 45 deg. will be adapted to any class of work desired—aside from frames and furnace work. In placing single forges along the walls there should be at least 5 ft. between the wall and center of stack, and the space between centers of stacks and the working room should be the same as allowed for the double forges, 15 ft. and 20 ft., respectively, making 375 sq. ft. of floor space necessary for the single forge against one-half that essential for the double forges, which is 262 sq. ft., leaving 113 sq. ft. in favor of each forge placed back to back, or 225 sq. ft. in favor of each double forge as against two single forges. Should the single forges be placed tight against the wall, which would be an expensive position when convenience of handling the work is considered, for convenience in this case means output, the saving even then in floor space in favor of the double forges against the two single forges would equal 75 sq. ft., and the number of stacks in the single forge plan and the holes in the roof will be increased 100 per cent. If stacks are not employed you have not an ideal shop, but rather an ideal smoke-house.

In connection with railroad blacksmith shops the writer does not advise arranging the forges in groups of four if the best results are desired. The writer has visited two new shops where such mistakes have been made and feels it some one's duty to enter protest as to the propriety of a plan that will produce an atmosphere in the shop that will simply suffocate or stifle the men who are compelled to work in it.

In designing forges some thought should be given as to proper dimensions, heating qualifications, storage of fuel, convenience, cleanliness, economy in fuel and shop space. The large or generally termed big forges are preferably made circular, and should have sufficient space allotted to them for the convenient handling of the heavy work. The frame forge should be about 36 in. sq. and made to drop about 12 in. Such a forge can be dropped quickly and the slow process with the chain hoist avoided and the fire left in good condition for the succeeding heat.

In connection with the forge we find quite a difference of opinion as to the proper volume and pressure of blast productive of the greatest efficiency, many claiming great volume with a pressure of five to seven ounces will produce the best results, but the writer, through experience, has determined that any volume that will fully supply each forge with a constant pressure from 14 ounces to 16 ounces through an upright opening in the tuyere equal in area to 2 or 2½ sq. in. is about the proper thing for railroad smith shops.

For ordinary work in the railroad smith shop the tuyere should be at least ten inches below the top of the forge. With this depth to tuyere and the fire prepared with fine wet slack well tamped around a stake the fire will, with possibly the throwing out now and then of a small clinker, last from 7 o'clock a.m. until noon, and with this depth to tuyere the slag and clinkers do not drop down and clog it as they will at a less depth; besides, we have a body of fuel below the iron sufficient to produce and continue to produce the necessary heat for the best results, and lessen the demand for a new fire at 9.30 a.m. and 3.30 p.m.

The shop should be equipped with wrought iron steel-faced anvils weighing from 300 lbs. to 400 lbs. each, placed on portable cast-iron stands. Each forge should have a full equipment of tools. Fifty cents expended in the proper tool will earn dollars for the employer, if in the hands of a competent workman.

If the accumulation of good wrought iron scrap is sufficient to employ the reverberatory furnace a greater part of the time, its use from a money saving standpoint is absolutely necessary, and in many localities where refined hammered iron of large dimensions cannot be received on short notice its services are required aside from the money-making qualities accredited to it.

As the demands for furnaces in the smith shop are many there should be special furnaces for special classes of work as follows: The large reverberatory furnace and the billet furnace, which may be of similar design, which will also make it useful in heating material for small forgings, car work to be formed on the machines, etc. Then comes the case-hardening and spring furnaces, and special furnaces for the heading and bolt machines, flue welding furnace, etc. Some of these special furnaces for special classes of work will increase the output over that of the forge from 300 to 400 per cent. as far as heating advantages go, but this would be profitless were it not met by an equal shaping capacity of proper machines.

Any old steam hammer with special dies producing any number of duplicate forgings will show a saving of ten dollars and up each day over the same class of work produced by hand, and if a 1,200-lb. steam hammer can be installed for 1,500 dollars the interest in the investment would at 4 per cent. amount to 60 dollars per year, or about the profit earnings of the hammer for one week over hand work, and if kept in constant service would mean a saving or gain of

*Extract of a paper by A. W. McCaslin read before the National Association of Blacksmiths held at Indianapolis, Aug. 16-18.

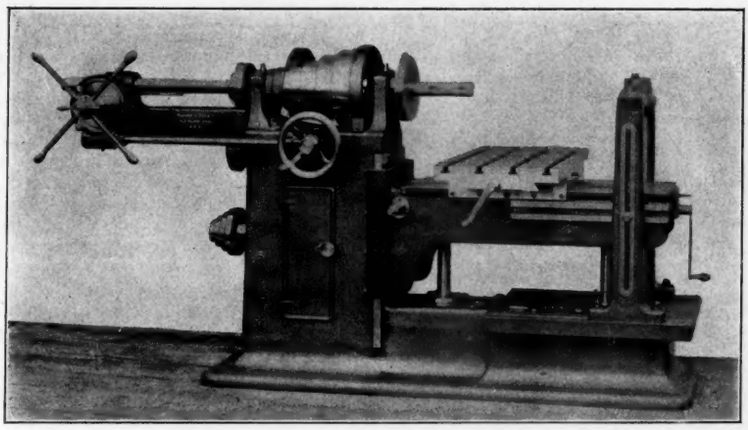


Fig. 1—The Warner & Swasey Horizontal Boring Machine.

about 3,000 dollars annually, and if operated only one hour each day would still be a profitable investment.

The number of cranes should be ample for all requirements, and when possible placed so as to interchange but not interfere with each other. The smith shop of to-day should be equipped with steam hammers, bull-dozers, heading machines, forging machines, bolt machines, punch and shears, etc.

Railroad companies that have built new shops in recent years have been lavish in the expenditure of money in the interest and comfort of the employee, and by the installation of improved machinery and appliances mentioned in this paper much of the laborious work formerly done through compulsion by man, is now cared for with little effort. But while the output is increased the demand for the man is not decreased, and being relieved of the laborious part which was formerly his, should he not feel like increasing his movement just a little?

Railroad Shop Tools.

(Continued.)

HORIZONTAL BORING MACHINES.

The horizontal boring machine, Fig. 1, is made by the Warner & Swasey Company, Cleveland, Ohio. The table of this machine is 20 in. x 36 in. It has a cross movement of 29 in., a lateral movement of 26 in. and a vertical movement of 20 in. The table can be raised or lowered from either the end or the side of the knee. The elevating screws are geared together and provided with an adjustment by means of which the table can be kept parallel with the spindle. The spindle is 2½ in. in diameter and has a maximum feed of 20 in. The machine cone takes a 3-in. belt and with the back gears there are eight changes of speed and four changes of feed. The feed is worked by a hand wheel at the left of the knee or automatically after turning the friction knob. Quick motion to the spindle is given by the handle at the left. A 12-in. double friction countershaft for a 3½-in. belt is supplied with each machine. This should run at 150 revolutions per minute and will give spindle speeds of 278, 183, 122 and 80 revolutions per minute without the back gears, and 36, 24, 16 and 10 respectively with the back gears.

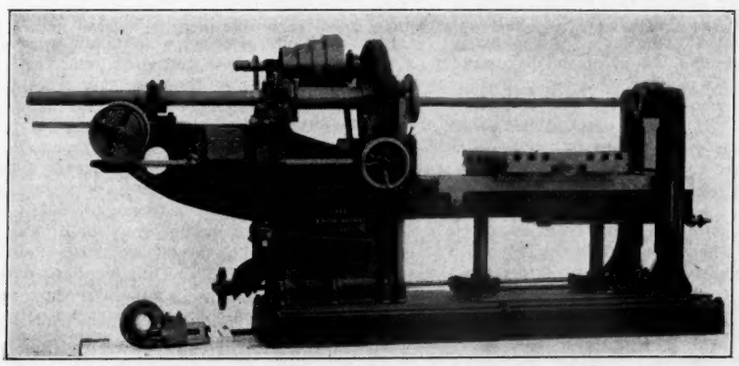


Fig. 3—The Binsse Horizontal Boring Machine.

be driven in either direction and it has a full bearing through the cast iron spindle at all times. It has a quick hand movement through a rack and pinion. Six changes of automatic feed are obtained by means of cut cone gearing. The spindle can be fed in either direction without reversing its direction of rotation. The table is 6 ft. long and is elevated by means of screws, worm wheels and worms, which are operated by power. The table carries a saddle which has a movement parallel with the main spindle. On this saddle is mounted a cross table 24 in. by 36 in. This is adjustable at right angles to the spindle and can be lowered until its top is 25 in. from the center of the spindle. Both the saddle and the cross tables can be removed when it is desired to increase the capacity of the machine. The maximum distance from the center of the spindle to the top of the main table is 30¾ in. The weight of the machine is 10,000 lbs. and the countershaft should run at 120 r.p.m. This machine was made for the Pittsburg & Lake Erie railroad shops at McKee's Rocks. It is equipped with a Crocker-Wheeler motor and the Morse Chain Company's silent chain drive.

The horizontal boring machine shown in Fig. 3 is made by the Binsse Machine Company, Newark, N. J. The boring bar is made of steel and is driven by two cast-steel keys. It has a No. 6 "Morse" taper hole in its ends and it is long enough to bore all holes larger than the bar diameter without using

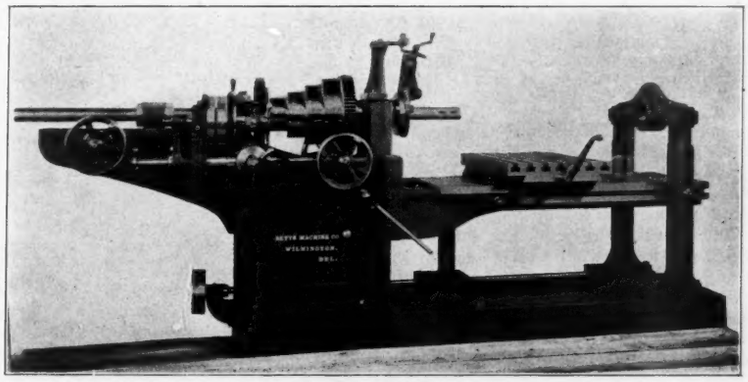


Fig. 2—The Betts Horizontal Boring Machine.

The horizontal boring machine shown in Fig. 2 is made by the Betts Machine Company, Wilmington, Del. The cone pulleys on this machine have four speeds for a 3½-in. belt. The machine is back geared and has eight changes of speed on the spindle. The spindle is cast steel 3 in. in diameter and has an adjustment of 24 in. through the cone. Provision is made for a 48-in. traverse of spindle if required. The steel spindle can a stub bar. The bar is fed by worm gearing, with rack and pinion. The machine is driven by the Binsse patent triple gear drive. As seen in the illustration, with this arrangement, the pull of the belt does not come on the main spindle. The friction thrust has two hardened and ground steel, anti-friction rings, which can be adjusted to take up lost motion, or wear. The bar can be held at any point by a friction clamp; thus the bar can always be fed the full length of the feed at one setting. The bar has two hand feeds, one fine and one very coarse. The power feeds are nine in number, two for drilling, five for roughing and two for finishing. These feeds are obtained by means of spur-gearing. The carriage has central and side guiding surfaces, and it is held to the saddle by a solid gib. The carriage has six wearing surfaces, and it is bolted to the saddle and table by four clamps. In this way, the saddle, carriage and table are practically one piece, and no working strains come on the cross-feed screw. Adjustable index dials aid the accurate reading of the vertical and cross movements, and facilitate setting the work rapidly. All the sliding surfaces are at right angles to each other. The table is kept in line by the faces on the head, and is braced by the yoke.

When the gibs which bind the table to the head are tightened, the table is brought in correct alinement. The table has a power lift, which can be driven at different speeds, according to the load; the fine hand adjustment being made by the operator while callipering the cylinder. The yoke is a box frame. It carries two bushings, one fixed, and one turning with the boring bar. Therefore the wear is taken away from the bar to the bushings, which can be replaced easily. A hand power movement is provided for moving the yoke. The facing attachment furnished with this machine is shown in the lower left hand corner of the illustration. The hub is split which enables it to be attached to the boring bar at any point on the bar without disturbing the bar or the work.

(To be Continued.)

How to Handle Freight Safely.*

The North Western advertises that it has the best of everything and that of course includes the men. It also claims to be the pioneer in this part of the country, and the officers believe that when the best lot of railroad men in the country understand the matter that they will see to it that what is necessary is done to make their company the pioneer in improving the handling of freight and so reduce the losses to a reasonable amount. The records for the 12 months ending May 31, 1898 and 1904. show:

	1898.	1904	Inc.	P.c.
[1]	$27,035,105	$37,665,007	$10,629,902	40
[2]	14,728	58,146	43,418	400
[3]	7,520	57,824	50,304	700
[4]	62,548	272,786	210,238	400
[5]	70,068	330,611	260,542	470

[1]Freight earnings; [2]number of claims; [3]freight lost; [4]freight damaged; [5]total amount paid for claims.

The increase in this account is partly the fault of the management of the company and partly the fault of the men who handle the freight traffic for the company. If you or I had an increase in our wages of 40 per cent. and increase in our cigar bill of 400 per cent. you know what would happen, and the same thing will necessarily happen on a railroad if this increase is not stopped; and we *must* stop it.

When the book of rules is silent, call for information on your superintendent, or the General Claim Agent or whatever official of the road ought to know and have him tell you. The man asked will be very glad the question is put to him, because it demonstrates to him that the agent making the inquiry tries to do right. It calls your officers' attention to the fact that you are trying to learn the right way to do the business. The men that get along in the railroad service are the men who do things right, men who were able to do things that are necessary in time of emergency. When everything runs smoothly there is no trouble, the thing runs itself, we don't need any officers then; but when an emergency arises or trouble comes up then is when the officer wants to get busy and earn his salary, and then is when you want to call on him. And by doing so you are calling attention to yourself and it may aid in bringing about your promotion. That is what we are all working for. Rule No. 3 instructs an agent to give courteously all information that is asked of him by our patrons so far as it does not interfere with the company's business or interests. We, however, are not to open our books for information or inspection to attorneys or any one else.

We had a short time ago a claim for $700 on a car of corn claimed misdelivered. When we sent out for information regarding that car we found that the attorney for the claimant had been there ahead of us and had been through the books and got all of the information he wanted. Now, that is the kind of information we don't want to give; if any one comes along and insists on getting such information refer him to your Superintendent, or to me.

We don't want to take any horses in less than carload lots going to points beyond our line unless there is somebody in charge of the horses. We are perfectly willing to accept such shipments for points local to the North Western because we have got our sign out to do any kind of business that it is proper for a railroad to do and we can't have too much of it—just at present we have too little. But our connections will not receive horses in less than carload lots unless there is some one in charge. Nearly every week we receive at Milwaukee, Chicago and other terminals such shipments that our connections will not accept because there is no one in charge. We have to pay for feeding the horses and we have got to take care of them, and I have got to get the other line to take the shipment or make some arrangement with the shipper and we have to make all sorts of concessions.

We don't want to accept shipments of returned machinery for repairs unless you receive an order from the shipper to take it back. We don't want to take shipments of agricultural implements, patent medicines or things of that kind for return shipment without such an order because the chances are that when it gets to destination there is a dispute and the original shipper says: I am going to sue the fellow up there for that stuff and I won't take it. And nine times out of ten we won't get our charges. We are under no legal obligations to advance charges to anybody. We don't have to loan our money to any one. While it has become customary to make proper advances on shipments from connecting lines, we never want to make any advances on shipments for more than one-half of what that shipment would sell for at forced sale. In determining the value of any article you want to base it on what you think you would pay for it if you wanted to make a purchase of that article.

Rule No. 15 says that freight must be properly marked with name of consignee and destination before being received for shipment. If it is so marked and should be carried by or go astray it can be promptly forwarded to proper destination under rule No. 94, if not marked we all know what becomes of it. I remember a claim of $800 or $900 on a shipment going from Parker to Amboy, Ill. There were 27 boxes shipped and when the gentleman came to ship them the agent said to him: "Why, you haven't got that stuff marked." The man goes out and marks it, the agent takes his word for it and bills it all right. But the man forgot to mark two boxes and left the old marks on them. The shipment came down on our road and was transferred with the exception of two boxes which were marked Morris. The shipment checked out 25 boxes and went along with the way-bill marked "2 short." When it got to destination it was two boxes short, of course. The stuff was valuable and we had a claim for it. The agent at the transfer point forgot to make an over report and left the two boxes in the car for Morris, Ill., on the Rock Island. They never reported it to us. They are poorer than we are and need all the boxes they can get more than we do. We traced those things up—I had to find it or lose my job. I can't afford to lose my job because I don't know anything else. We found that this shipment had been transferred and followed the original car which had gone to the Rock Island Road. We sent down to where the car went and there were the two boxes as big as life with the old marks on them but no new ones. Now if the two boxes had been marked we would have been saved all this trouble and expense as they would have been forwarded to proper destination by the Rock Island in accordance with the general understanding among railroads even if our agent at transfer point had made a mistake in the transfer.

Rule No. 23 says that before we receive property for shipment we must check it. We must know the condition of that property when delivered to us for transportation. The receipt is worth exactly what the property is worth as long as the North-Western Railway Company is good. If Mr. Smith gives me his note for $150 it is good just as long as he is good for it. Just so with the receipt; as long as the North-Western Company is good we either have to deliver the goods or pay for them. Last fall we had a claim of $578, the value of 98 bales of twine alleged to have been shipped from Ute to Omaha; when the car reached its destination it was under seal, was full, but short 98 bales from the billing. Our receipt was out for the twine and the agent issuing it claimed he had actually checked it into the car. It was up to my department to convince the holder of the receipt that it was a mistake, and we finally did it. Perhaps you think it was an easy job. A little while ago we had a claim for $1,600 shortage on a car of butter and eggs going from some point out in Iowa to New York City. The agent, of course, issued a clean receipt for it. I think it was invoiced at $2,100 and when it got there there was only $500 worth of property in the car. The man who got his receipt had taken it to the bank, draft had been drawn on it, he got $2,100 and Mr. North-Western got a claim. Don't receipt for a car load of freight loaded by the shipper unless you put on the receipt "Shipper's Load and Count." If you get a car of corn offered you, look and see if there is corn in the car. We had a claim the other day on a car of corn from Missouri Valley going up to Manitowoc and when it got to Manitowoc there wasn't a pound in it. Now, nobody had taken that corn out. It was simply an error of the man that was supposed to have her loaded out, yet the North-Western Company's clear receipt is out for that property, and what are we going to do about it? What would I do if you made a note for $700 and gave it to Mr. Lawson and he gave it to me or sold it to me for $350? When that note became due you would have to pay me $700. You might say that I only paid Mr. Lawson $350. That wouldn't make any difference. Here is your signature for $700 and you would have to pay the note if you were good. If we issue a receipt and it gets into the hands of an innocent holder we have got to pay for the stuff it calls for or deliver it. That is one of the things

*Extracts from an address by R. C. Richards, General Claim Agent of the Chicago & North Western, recently delivered to the agents of the company, at meetings held in Chicago, Boone, North Fond du Lac, Madison, Escanaba, Waseca, and Huron. For the benefit of agents who were not able to attend the meetings the address was printed in pamphlet form, with the following introduction by General Manager W. A. Gardner:

"Employees who were able to participate in the meetings, which this pamphlet records, will secure additional pleasure and profit in an opportunity for review. The large number whose duties would not admit attendance will find the first page so interesting as to require no other incentive for completing the whole. . . . Those who make rules are not infallible, and those who should observe regulations are not always keenly alive to the disastrous effect which may result from a trifling cause. The severest, most impartial, and always reliable teacher is Experience, and, whether we be machine-made from the University or hand-made from the Universal, no little portion of our success as individuals or corporations is to be attributed to our faculty for avoiding the difficulties which have jeopardized others. . . ."

which is happening all the time, and that is one of the reasons the damage account has increased 400 per cent. and the shortage 700 per cent.

We have a legal right in every instance to make a man who comes to us for freight give up the bill of lading. That is a legal right we have. Now, we don't want to do that with every man. We have a lot of people in this town receiving shipments every day and we ought to deliver their freight to them without the bill of lading unless shipped to *order* or *notify*. But if you have any doubt about the consignee or he is a stranger to you you say to him: The company requires me to take up the bill of lading, you are a stranger to me, and under the rules and regulations of the company I cannot make delivery without your surrendering the bill of lading. Tell him: There is a son-of-a-gun down in Chicago who will raise Cain with me if I deliver those goods without surrender of the bill of lading. Put the blame on me or Mr. Lawson if you don't feel like taking it yourself. You are not to blame for the rules the company makes. But don't deliver it. When in doubt take the safe course. If you do that you will be all right and so will the company.

We had a claim of $100 a few days ago on a shipment of potatoes for Mounds, Ill. Now there were two Mounds in Illinois, one on the Illinois Central and one on the Wabash. We were instructed to send it via the Illinois Central. The agent in billing the shipment billed it via the Wabash. We delivered it to the Wabash. It cost us something like $100 to get the shipment back to the right place. They were as far apart as two places could be in Illinois; all of which might have been saved if when that way-bill was made it had been compared with the shipping directions. It would not have taken one-tenth as long to do that as to write letters and explain why the mistake was made.

We have any number of claims presented for damage to machinery and to threshing machines, especially threshers. It seems to me some switchmen take a special delight in making a fly with a car of threshing machinery to see how hard they can let it bump up against the other cars or bumping post. Before you receipt for machinery on open cars look it over and see if it is all right. We are getting claims all the time for tools and tool boxes missing. They pass through the country and every man that has a threshing machine wants the tools and helps himself. When they ship tools and boxes on an open car, look and see if they are there and receipt for the freight as you find it. It isn't at all unusual to get a consignment of a dynamo costing all the way from $2,500 to $10,000. If any of you gentlemen were in business and you were getting a $10,000 dynamo, you bet your life before you took it from the North-Western's platform you would know whether it was in good or bad order. If it was in bad order you would call the attention of the agent to it and receipt for it in that way, and that is the way we want you to handle the business of the company. Do it as you would do your own business.

Some of the eggs unloaded at Chicago look as if they had been shot out of a cannon. The cases look as if you men loaded this stuff and bumped it up against every other case in the car, and then some switchman had taken the car up to the roundhouse and tried to knock a hole through the wall. All eggs are broken right in the end of the case. A good many cases are not fit to carry eggs. Now, you ought not to accept them in packages unfit to carry them. Every three months or so I have reprinted rules 16 and 17 telling you not to receive shipments unless properly crated. I had them reissued a week or so ago and had part of it printed in red ink, thought if you saw the red ink you would think it was a danger signal, but don't know if any of you have seen it. I think we had 199 claims for eggs damaged in transit for the month of June. That is too many. If they are packed in proper cases and we load them right and cars are handled with ordinary care they will reach destination all right. If they are not packed in proper cases refuse to receive them. If they were properly loaded and carefully broken down so that they will not slide all over in the car we wouldn't have all those claims.

A little while ago we had a claim for $1,195 on a type setting machine. Now those things are about as delicate machinery as can be made, and they are expensive. They don't weigh much. I guess we got about $4 for taking it from Marinette to Manitowoc. When it got there it looked as if it had gone through a threshing machine, and, of course, we had to pay for it. In the first place it wasn't properly crated for transportation and then it wasn't properly loaded—it wasn't secured in the car. We could better have afforded to have paid something to have it properly crated than to have taken chances of paying $1,195, and if any of you gentlemen incur any expense of this nature put it on the way-bill as advances, that is where it belongs, and if the consignee refuses to pay and your Superintendent won't refund it to you, call on me. I will pay it every time and be much obliged to you in the bargain. We can't afford to take any chances with that kind of stuff. Nobody could stand the loss but a railroad company. And the more money that is saved in cutting down this expense the more there will be left in the treasury of the company for improving facilities, dividends and higher wages, and the next time your committee goes down to Chicago and wants your hours shortened and your pay raised, tell the General Manager you have reduced the damage account $100,000 by exercising more care and following instructions. That will be a point to use with him. And it will be a good point and he will give it consideration. If any other item of the operating expense had increased 700 per cent. or 400 per cent. in seven years as the freight losses and damages have there would be a receiver in Chicago instead of a president and our wages instead of being increased as they have been would have been cut down.

I had a claim presented last week on a shipment going to Chicago, I think it was $241 damage to butter loaded into a dirty refrigerator. The conductor swore up and down that it was clean, but the agent says it was dirty. He forgot to clean it. He told the truth. At least the presumption is that he told the truth. If the agent or the conductor had taken the trouble to clean the car before they loaded the property into it, it would take them actually less time to do it than to write letters explaining why it was not done. If it had been their stuff they would have cleaned the car before they loaded it. Why shouldn't they do it for the company that pays them?

Don't load flour, sugar and stuff like that which will be damaged by water into a refrigerator car. We had a claim a short time ago on a shipment of silk which was carried in a refrigerator car with the ice-boxes leaking, waste pipes blocked up with dirt. The silks, of course, weren't damaged, oh no. They were simply drowned. There was about two inches of water on the car floor and when the doors opened out came the water, and in came the claim. This time it cost the company over $100. If the car had been examined before it was loaded the damage would not have occurred.

(To be Continued.)

The Theory of Accident Statistics.*

The hackneyed subject of railroad accidents has received increased attention of late, but the various discussions do not throw much light on the questions dealt with. Everybody seems to feel as helpless as ever in the presence of the Juggernaut which kills over a thousand passengers and railroad employees every year, to say nothing of the other thousands killed at highway crossings and by falling off cars, and in those other classes of accidents which are not always chargeable to train movements. What is the matter? The first point in the study of statistics is to find out exactly what the figures mean. Numerous writers confuse the totals in the train-accident class with the total of all accidents, thus leading to absurd conclusions.

Not long since comment was made on the remarkably small percentage of deaths and injuries occurring among passengers riding in sleeping cars, in the State of New York, during a given period; but the most important element in the explanation of this high immunity—the fact that sleeping cars are always, when possible, run at the rear end of the train—was not mentioned. A collision which caused the death recently of six passengers on an electric railroad in Ohio illustrates the other aspect of this feature of the safety of passengers; the six victims in this case were in the forward end of the only car in the "train," and of course bore the brunt of the collision. These hapless victims were, in fact, in a more dangerous position than that of the average engineer on a steam railroad train, for the engineer is on the alert and he knows the road and all its peculiarities.

Accident records for brief periods are of but little value. Those accidents which cause numerous deaths of passengers, swelling the records and drawing attention, occur with comparative infrequency, thus making it necessary to examine the statistics for a long period of time if it be desired to draw lessons therefrom. Comparisons of the records of one part of a country with another, or of this country with European countries, must be used with great caution, because of the differing circumstances.

A trans-continental railroad 2,000 miles long may carry no more passengers than a road in the thickly settled Eastern States less than 100 miles long. The average per mile of railroad has no meaning in a comparison between two such lines and is of no value unless the number of passengers and the number of trains is taken into account. Even then the figures must be used with caution, because the number of freight trains, the presence of which adds to the risk of accident to passenger trains, needs to be known. The number of passengers carried by any particular road, as shown in its annual report, is a very inaccurate basis for any comparison until it is known whether these passengers traveled ten miles or 1,000 miles each. Comparing one country with another is even less satisfactory than comparing different parts of the same country, or one railroad with another; for complete statistics, tabulated on the same basis, are not available for any two countries. Men working in shops are in some cases classed as railroad employees and in others are left

*Extracts from an article in the *Commercial and Financial Chronicle.*

out of the account. If all these difficulties were removed, we still have the greatest weakness of all—the fact that our statistics throw no useful light on the real causes of the deaths and injuries. The true theory of accident records makes of them a guide for marking progress forward or backward, in the same territory or on the same road, and very little more.

But if the theory of statistics is to be thus narrowed down to a point where it affords no aid in making life and limb safer, what is to be done? The most rational reply to this query is to be found in the way that the theory of accident statistics is extended by the Government statistician to include *detail causes*. He does not confine the quarterly bulletins to dry comparisons of one quarter with another, but gives also a list of causes of the worst collisions and derailments. In bulletin No. 8, which contains the statistics for the year ending June 30, 1903, the last quarter of that year is dealt with in considerable detail, and there is a table giving notes of the causes of 43 of the most disastrous collisions and derailments. Let us glance at these notes. . . .

These are statistics which have a vital meaning. Failing to extract lessons from averages or totals or comparisons of years or of countries, the next thing is to study the causes of individual accidents; and here we find the facts which enable us to do so. Where men make a mistake in calculating time by their watches and time-tables, killing a dozen of their fellow-employees, the public very naturally inquires why the block system, as used on many roads and which makes such time-piece calculations unnecessary, is not more generally employed than it is. If a locomotive engineer or a flagman who commits a costly and fatal blunder has been on duty 20 hours, the question arises, what kind of a superintendent was it that permitted this excessive work? If a collision is due to the fact that only one man on a train was familiar with the stations, signals, time-table, etc., some grave defect in system would seem to need investigation. And so on through the list.

Railroad accident statistics which really show causes are a public benefit, for they keep the salient facts before the people, and they afford a basis for whatever action may become necessary to regulate unenterprising railroads so as to bring them into line with the larger companies in the matter of safety regulations and appliances; but it is worse than useless to try to deceive ourselves by reading into the statistics what is not there.

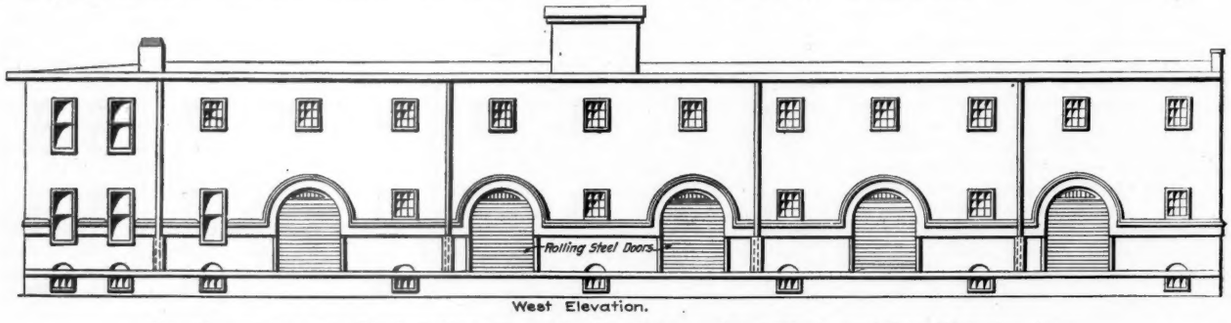
Concrete Block Freight House for the Chicago Great Western.

A freight house built of concrete blocks has lately been completed by the Chicago Great Western at East Waterloo, Iowa. The building is 32 ft. x 155 ft. and has two stories and a basement. East Waterloo is a city of about 17,000 inhabitants and the average monthly freight business is $25,000. The former facilities consisted of a one-story frame building, 30 ft. x 130 ft., which was moved to a site adjoining the new house and is used in conjunction with it.

The foundations of the new building are stone, the walls being 24 in. thick and resting on footings 3 ft. deep and 5 ft. wide at the bottom course. Walls and footings are rubble stone laid in concrete mortar. The walls of the first story are 16 in. thick and for the second story are 12 in. thick, the size of the blocks for the two stories being 9 in. x 16 in. x 30 in. and 9 in. x 12 in. x 30 in. respectively. Mixtures of four and five parts of coarse sand to one part of cement were used for the blocks for the walls, while for the trimmings such as the water-table, window sills, arch blocks, etc., a two-to-one mixture, with a finer grade of sand was used. The blocks were laid in a two-to-one Portland cement mortar with ¼-in. horizontal and vertical joints. They were all laid in the winter, during freezing weather, the sand and water being heated.

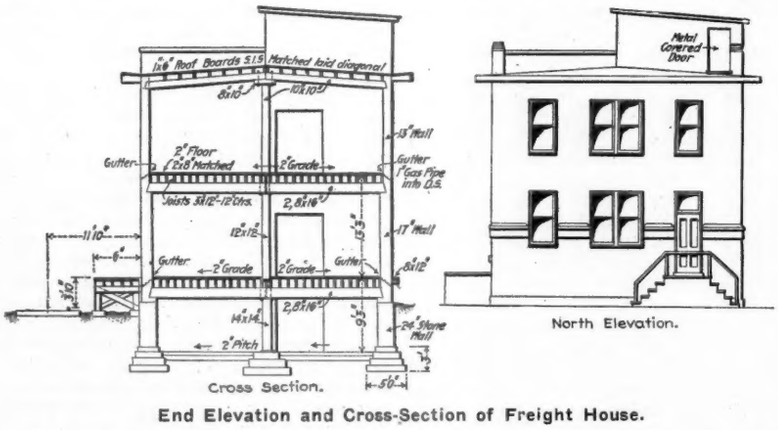
The roof is three-ply asphalt, over 1-in. boards. The floors are carried by timber girders composed of two 8-in. x 16-in. pieces resting on posts at the center of the building, which are 14 in. x 14 in. for the first floor, and 12 in. x 12 in. for the second. The joists are 3-in. x 12-in. and the maple flooring is 2 in. thick. The floors are given a 2-in. grade from the middle toward each side and are made tight, with gutters along the walls to permit flooding without wetting the floor below. The head-room in the basement is 9 ft. 3 in. and the floor is 1 in. of cement on 5 in. of concrete above a 6-in. sand filling. There are three chutes for unloading freight into the basement, and there is also a cooling room at one end which is large enough for three carloads of fruit.

On the track side of the building there is an uncovered platform 6 ft. wide. There are six 8-ft. doors on this side and four on the team side, rolling steel doors being used for all ten openings. The offices are at one end of the first floor, and space has also been provided near the center of the building for an elevator to run from the basement to the second floor. The house is lighted by electricity, and there is also provision for lighting cars during loading and unloading.



Elevation of Concrete-Block Freight House for the Chicago Great Western at East Waterloo, Iowa.

The concrete blocks for the building were supplied by the Concrete Stone Company, of Waterloo, and were made in Palmer machines. The cost for a building of this kind ranges from 28 to 32 cents a square foot laid in the wall. We are indebted to Mr. A. Munster, Acting Chief Engineer of the Chicago Great Western, for data.



End Elevation and Cross-Section of Freight House.

Foreign Railroad Notes.

The members of the Strike Committee which conducted the strike of Hungarian State Railroad employees were tried by a criminal court and all acquitted. The judges introduced their finding with a speech, in which they substantially condemned the strike, but they found that the abandonment of their work by the men was not in law a crime; and, further, they found that these employees are not State officers, having no other privileges than those of employees of private railroads.

A German commenting on the frequency of railroad accidents in Russia, where the low rate of speed and the relative infrequency of junctions, etc., would seem to favor safety, says: "Without doubt the untrustworthiness of the lower grades of employees has much to do with it. This is the worst feature of Russian railroad management, because the untrustworthiness is due in part to the very character of the people; in part to defective instruction. The people have not been accustomed to observe and fulfil exactly relatively trifling tasks; perhaps they cannot be trained to do so, because it is not in their nature."

GENERAL NEWS SECTION

THE SCRAP HEAP.

On the night of August 17 an experimental train was run over the New York City subway from the City Hall to Harlem, about nine miles, in 15 minutes.

The Canadian Pacific has announced that beginning September 15 storage will be charged on goods in freight houses after 72 hours. The rate will be from one to two cents per 100 lbs. per week.

It is reported in the newspapers that the Department of Commerce and Labor is investigating the private car industry, with a view to learning the facts as to the relations between these companies and the railroad companies.

The judges of the Supreme Court of Georgia have given up their railroad passes, the Legislature having passed a bill increasing their salaries and prohibiting the use of passes by the judges of this court. The bill also prohibits the use of passes by the judges of the Superior Court, but it does not increase their salaries at present.

At Boston last week the railroads secured from the Superior Court an injunction against a half dozen ticket brokers restraining them from dealing in G. A. R. excursion tickets. In the United States Circuit Court at St. Louis, August 12, B. Wasserman was fined $500, and L. Aaron $250, for contempt of court in violating an injunction restraining them from dealing with nontransferable tickets.

The Panama railroad having come under the control of the United States Government, certain commercial interests of the Pacific Coast have been trying to get the Government to abrogate the contract between the railroad company and the Pacific Mail Steamship Company by which the latter has a monopoly of the westbound freight delivered by the road at its Pacific terminus; but it appears that the Government can take no active part in the management of the railroad until the terms of office of the present directors expire.

Railroads Across the Pyrenees.

According to press reports a Franco-Spanish convention providing for building three lines of railroad across the Pyrenees was signed Aug. 20. It provides for their completion within three years. It is anticipated that the new lines will greatly increase the friendly relations and commerce between the two countries, and that they will also constitute an important step toward the spread of French influence in Morocco, communication with which will be much quickened and facilitated.

The Banner Blue Limited.

This is the name of the "crack" day train of the Wabash between Chicago and St. Louis, and the company has just put on complete new equipment, built by the American Car & Foundry Company, at the St. Charles shops. Each of these trains consist of four cars: a baggage and smoker; a combined coach and chair car; a dining car, and a parlor car. All are finished inside in mahogany, inlaid with holly. The cars are lighted by electricity, generated by Gould's patent axle motor. Besides the lights in the roof there are rows of incandescents along the inside of the car just above the seat, so that each passenger can turn the light on or off as he may wish to read or sleep. The windows are wide, and above each is an arch of art glass. The curtains are of green tapestry, and the carpets and the plush on the seats are also green, this being the color scheme throughout. Each car has two electric fans. The combined day car and chair car seats 80 persons, and the two parts of the car are separated by an ornamental arch, not a closed partition. The dining car has both charcoal and Pintsch gas fires in the kitchen. It has a small room, accommodating six persons, partitioned off from the main dining room, and it also has a cafe and smoking room in which four persons can dine. The dining cars run through between Chicago and St. Louis.

Comment on the New Haven's Action.

It is inevitable that steam railroads must run some trains which do not every day show a profit to the road. If this were not so the railroad service of the country would be poor indeed. If it is allowable to take trains off at the first indication they are not paying then it would be almost as justifiable for a railroad president to throw up his chamber window, and finding it raining, wire the division superintendent not to send the trains out in the wet, because nobody would ride in them on such a day.—*Newburyport (Mass.) News.*

Texas 16-Hour Law for Trainmen.

The State of Texas has a law, passed by a unanimous vote in the Legislature in March, 1903, forbidding railroad companies to keep trainmen at work more than 16 hours. The law is rather loosely drawn and it would appear to be doubtful whether it will be of any more practical effect than the similar laws in a number of other States which seem to be dead letters. It is to be tested in court, however, some of the yard men employed by the Galveston, Houston & Henderson, at Galveston, having got the county attorney to enter a suit, to be tried at the October term of the District Court. Section 1 of the Act says that the classes to which it applies—conductors, engineers, firemen, brakemen, train despatchers, telegraph operators and trainmen—must not "again go on duty or perform any work" after a 16-hour tour, without eight hours' rest. Whether the law will be held to apply to switchmen in yards remains to be seen. A proviso says that the law shall not apply in case of "casualty." A casualty, according to the dictionary, is anything that happens by chance, which would seem to give the lawyers an opportunity for a little sparring. The complaint in the suit mentioned says that the men of a certain yard crew began work at 7 a.m. Sunday, June 10, and were required to work until 6.50 a.m. on Monday; and that on Monday the company permitted the men to again go on duty without eight hours' rest. The penalty is from $100 to $1,000 for each offense.

Iron Ore Production.

For the past nine years the United States has been the largest producer of iron ore in the world. Prior to 1895 both Germany and Great Britain each year, with three exceptions, mined more iron ore than the United States. Since 1901 this country has each year produced more iron ore than both Great Britain and Germany combined. The figures of the United States Geological Survey show that in 1903 the United States produced 35,019,308 tons of iron ore. From 1895 to 1901, the latest date where official data is available, the production of the three countries was:

	Great Britain. Gross tons.	Germany. Metric tons.	United States. Gross tons.
1895.....	12,615,414	12,349,600	15,957,614
1896.....	13,700,764	14,162,335	16,005,449
1897.....	13,787,878	15,465,979	17,518,046
1898.....	14,176,938	15,901,263	19,433,716
1899.....	14,461,330	17,989,035	24,683,173
1900.....	14,028,208	18,964,294	27,553,161
1901.....	12,275,198	16,570,258	28,887,479

In 1901 the 28,887,479 tons of ore produced by the United States exceeded by 42,023 tons the combined output of Great Britain and Germany, which amounted only to 28,845,456 tons. The high record of production in this country was reached in 1902, when the total was 35,554,135, in a combined world output of about 87,000,000 tons. Germany reached its highest record in 1900 with 18,964,294 tons, and Great Britain its maximum in 1889, when its total was 14,546,105 tons. In 1901, the year when this country for the first time produced more ore than Great Britain and Germany combined, the total world output of ore was 79,981,935 tons, leaving only 51,094,456 for the entire world outside the United States, whose production was 28,887,479 tons. This year the United States will probably lose its present position as the producer of more iron ore than Great Britain and Germany combined. The strike of the Lake steamship employees, which tied up the ore boats for one month, and the depression in the iron and steel trade will likely bring the year's ore production below 27,000,000 tons.—*Wall Street Journal.*

An Experience in a Subway.

Those Bostonians who think they have seen the Park street subway station crowded to its capacity would have had an eye opener as to the real meaning of the word "crush" had they been in the station yesterday afternoon after the big G. A. R. parade.

It was push, shove, slam, rush for three solid hours. A light, drizzly rain set in about 4 p.m. and this caused the crowds to make quicker time in reaching the cars, and consequently there was one grand stampede for the subway stations, but Park street, always jammed every day between 5 and 7 p.m., got more than the lion's share this time. Never were there so many people in that station for a short space of time.

But once arrived in the station they found that above ground was paradise to the condition of things below. Back and forth surged the perspiring people; now towards the cars that moved like snails around the loop, and then backwards against the iron railings and steps that lead to the elevated section. Numbers of women were hurled in front of the electrics, but as quickly picked up by the watchpost guards who were scattered everywhere to handle the thousands. Children were trampled upon by men in their mad attempts to board the car before it came to a full stop, and several times violence was resorted to by the officials in bringing men and women to reason.

The foul air caused by the densely packed horde of humanity combined with the idea in the minds of many strangers that they would never get out alive brought on nausea to scores. This made the situation doubly bad as there was no way to get the faint and frightened out of the place.

It is conservatively estimated that no less than 15,000 persons passed through the Park street subway turnstiles in two hours. Con-

sidering what the employees had to deal with the crowds were handled in good shape and while there were countless minor accidents according to eye-witnesses there were few serious casualties.—*Boston Advertiser.*

Standard Test Pieces.*

In order to secure comparative tests of rolled steel of different thicknesses, it is necessary to have a fixed relation between the width and the thickness of the test pieces. The importance of this has been recognized for years, and it has been used in scientific testing, but although attempts have been made to use the same fixed relation in the every-day work of commercial testing, it has not been found practicable on account of the great expense and delay in preparing the test pieces of the different widths required.

The recent paper by Professor Unwin, before the Institution of Civil Engineers, on "Tensile Tests of Mild Steel and the Relation of Elongation to the Sizes of the Test Bar," gives the results of the series of tests which he made for the Engineering Standards Committee. These and the formula he advises are now available. He tabulates the percentages of elongation of plates with thicknesses from ¼ in. to 1¼ in., obtained from test pieces 1½ in., 2 in., and 2½ in. wide. He finds that the differences of percentage elongation obtained from test pieces of these three widths are fairly uniform, the elongation being greater, the wider the test bar. The paper and the subsequent discussion are well worthy of study by all interested in this important subject. The Standards Committee have taken these results and arrived at the standard test pieces given in another column. The value of this work consists of the simplification and the practicability of its results. It points toward harmonious working with the International Testing Association and with the American Society for Testing Materials. It has been decided to use only three widths of test pieces for all thicknesses of steel rolled into plates, or shapes. This does away with all of the former objections that were raised, as the manufacturers can now prepare a whole chuckfull of pieces of one of these widths, just as cheaply as formerly they made all the pieces of one width. The widths of test pieces decided on and the variations are sufficient to satisfy those who formerly used very slight differences in widths. The present widths suggested are practical working limits for the shop and are a great advance on the old methods of compelling the use of only one width, and they put no hardship on anyone.

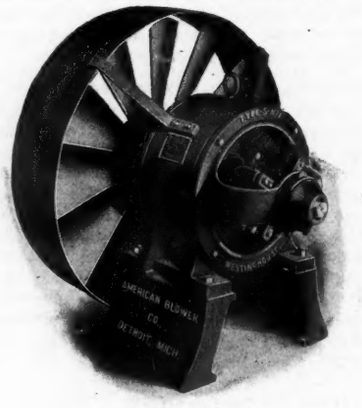
Particular attention is called to the note which states that these sections do not preclude the use of test pieces 1½ in. wide. This is important, as it is a recognition of the standard width of 1 in. and 1½ in. decided on by the Committee of the American Society for Testing Materials, which is affiliated with the national society. The American Society is the national clearing house for all matters pertaining to the testing of steel and specifications, and structural materials. The work of the American Committee has been on broad lines, and there is very little question but that they will adopt, in preference to their own, the standard test pieces.

The commercial value of the standardization of test pieces is that it makes the results less costly to the manufacturer, and more readily available and comparable by the engineer. It is pre-eminently that kind of service in which the scientific men do the most to help those engaged in the arts of construction. The work of the Engineering Standards Committee has been well begun in this and other work. Supported by the Government, and by the Institutions of Civil Engineers, Mechanical Engineers, Electrical Engineers, and Naval Architects, and the Iron and Steel Institute, and working in harmony with the American societies, it is a present powerful influence in maintaining commercial supremacy. Open discussion of the details of the work of the committee will help them and help to a better appreciation of the conclusions to which they come. Such discussion is invited in these columns.

*From *Transport and Railroad Gazette.*

A Direct-Connected Motor Driven Fan.

The accompanying illustration shows a direct connected disc-fan made by the American Blower Company, Detroit, Mich. The fan is a modification of the company's "A, B, C" fan, and it is driven by a Westinghouse motor. Instead of attaching the motor to the arms of the fan the motor is placed on a substantial base and the fan direct connected, thus doing away with all bearings except those in the motor. This makes a rigid construction and at the same time it takes up no more room than the overhung type.



Costly Freight Service at Buffalo.

The question of train load is probably now receiving the attention it deserves. Next in importance is the terminal situation. Efficiency here does not show up in a single index figure, as in the case of the train load, and it therefore more often receives secondary consideration. The general superintendent watches his terminals sharply to avoid a blockade, but after that there is not any general and constant supervision to hold the expense severely in hand. Ill-designed yards can cost the railroad thousands of dollars. The several local yards in a great terminal frequently are the heritage left from the small independent roads which have been consolidated. One manager in the east has so far appreciated the importance of this matter as to detail a staff official to the study of the whole system of terminals. His entire and constant duty is to inform himself on the terminal situation and make suggestions. At Buffalo the great eastern gateway across the "frontier" so awkward and inharmonious is the whole arrangement, that one switch engine and crew handle only about 35 cars per day. When we recall that in an ordinary switch yard an engine and crew are supposed to handle 300 cars and more per day, some notion of the waste can be formed. The difficulty is due to the lack of some basis of co-operation among the several roads, so as to eliminate the duplication of tracks and of service. There is probably not to be found elsewhere in the United States as badly arranged a terminal system, taken as a whole, as is to be found in Buffalo. The problem is not one for yardmasters nor yet for chief engineers at this stage, but for executives. Some plan of "getting together" should be worked out before more money is wasted at Buffalo.—*Wall Street Journal.*

Electrification of English Railroads.

The following paragraphs are of interest as showing the rather decided trend of the opinion of English railroad officials toward belief in electrification of steam railroads for short-haul traffic.

The Metropolitan Railway Co., of London, has made considerable progress during the past few months with the electrification of its lines. Thirteen new corridor chairs have been built and are being electrically equipped at Neasden, while the rest of the new rolling stock is being constructed at Manchester and Birmingham. The Harrow & Uxbridge division, though at present using steam locomotives, has been electrically equipped, and, when the other portions of the road are changed over to electric traction, this portion will also be operated by electricity. It is reported to be the intention of the Chairman of the committee, Sir C. B. McLaren, to visit the United States very shortly in company with some of the principal officials, in order to study the methods of the railroads in this country which are being run by electricity.

The directors of the Barry Railroad Co. sent a special committee, not long ago, to the Continent to inspect the electric railroad systems there. The report prepared as a result of that visit has led the board to express the opinion "that passenger traffic on certain portions of the railroad will be more economically worked by the limited use of motor coaches." It is said that this company will soon begin using a few motor coaches as an experiment.

The Metropolitan & District Railway reports successful progress with the work of electrification. The Chelsea power station is practically completed, 420 new corridor chairs have been ordered and parts of the road have been equipped electrically.

The North Eastern directors say that there is every indication that the results, both as regards revenue and convenience in working, following the substitution of electricity for steam on the suburban passenger trains on the Newcastle & Tynemouth and Riverside branches appear to be entirely satisfactory.

Lord Hamilton, in addressing the Great Eastern shareholders on July 27, referred once more to the electrification problem. He stated that, together with the General Manager and five other officials of the Great Eastern, he had recently visited France to see the electrically-equipped railroad systems which were being operated there. He said that, although there was much that was commendable in the systems, he had found nothing that he could recommend with full confidence. The Great Eastern has, however, started a service of road motors between Lowestoft and Southwold and between Ipswich and Felixtowe. As this service has only been in operation a short time, it is too soon to determine as to the ultimate success of the experiments.

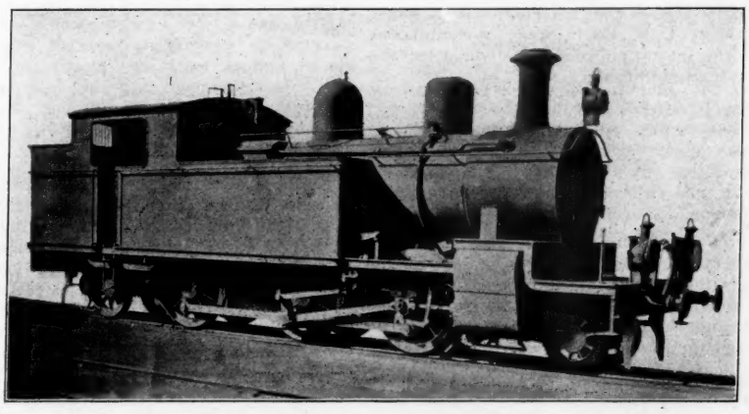
German Locomotives for Japan.

A recent report of the British Consul at Tokio, on imports in Japan of locomotives from the United Kingdom, states that the value of these imports in 1902 was $845,000, and in 1903 was only $768,000, while on the other hand the imports from the United States increased from $354,780 in 1902 to $560,000 in 1903. While the British locomotives seem to be superior in economy of coal consumption and possibly in finish and workmanship, the American built engines

cost less to buy and deliveries have been made in shorter time, and both of these points are of primary importance to the Japanese railroads at this time, when their facilities are being taxed to their utmost in the transportation of troops and munitions of war. The Japanese are becoming more accustomed to the American pattern and prefer it to the British types, particularly because of the ease of making repairs. Germany has recently been successful in obtaining an order for 30 locomotives for the Imperial Government Railways, thus making a third competitor in the field.

The order for 30 locomotives was divided between the Hanover Machine Building Company and Messrs. Henschel & Son, Cassel, which each received an order for nine and the remaining 12 were ordered from the Berlin Machine Company. The tender of the Hanover Machine Building Company was $9,666 for each locomotive and $3,436 for spare boiler and wheels. The Berlin Machine Company's bid was $9,695, and one English bidder who, however, did not receive an order, put in a bid of $9,760.

The accompanying illustration shows one of the engines built on this order by the Hanover Machine Company, whose works at Linden, Hanover, are one of the largest and best equipped engineering establishments in Germany. It is built for 3 ft. 6 in. (meter) gage, which is the Japanese standard, and has a leading and trailing pony truck with six-coupled drivers connected on the outside, the wheels being equalized in pairs from front to rear. The plate frames are ⅞ in. thick, and the draft gear and buffers are Imperial Government Railways' standard. The following table gives a few of the principal dimensions.



German Tank Locomotive for Japan.

Total weight in working order	125,000 lbs.
Wheel base, total	27 ft. 6 in.
Wheel base, rigid	13 ft. 9 in.
Height of center of boiler from rail	7 ft.
Heating surface, fire-box	79 sq. ft.
Heating surface, tubes	885 sq. ft.
Heating surface, total	964 sq. ft.
Grate area	20.6 sq. ft.
Drivers, number	6
Drivers, diameter	49 in.
Truck wheels, leading, diameter	29½ in.
Truck wheels, trailing, diameter	37½ in.
Cylinders, diameter	16 in.
Piston, stroke	24 in.
Valve gear	Walschaert, outside
Valves	Piston
Type of boiler	Belpaire
Diameter of barrel	3 ft. 11⅛ in.
Length of fire-box	65 in.
Width of fire-box	43½ in.
Depth of fire-box, front end	56⅝ in.
Kind of grate	Rocking
Tubes, number	158
Tubes, material	Solid drawn brass
Capacity of water tank	1,920 gallons
Capacity of coal bunkers	3,500 lbs.

The Train Despatcher.*

The criticism which really injures the despatcher is that which arises from post mortem examinations of the train sheet, wherein it is shown that the inferior train would have had plenty of time to go to the next station, etc. One incident will serve as a fair sample. A local freight, which we will call No. 93, was within seven miles of its destination, with a full tonnage train. Being at the foot of a heavy grade, the run would consume from forty-five to fifty-five minutes. It was waiting to meet a passenger train, expected at 12:45. At 12:40 an extra reported ready at the terminal, the destination of No. 93, as before mentioned, with about one-fourth of a train, and should have been able to run down the hill in one-fourth of the time the local would have used going up the hill. What would you have done? Probably the same as he did, unless you were a clairvoyant and could see the end from the beginning. But how did it turn out? The extra was delayed getting out of the terminal, and left at 12:55, used thirty minutes running seven miles down hill, and for some reason (we never knew what) No. 93 did not leave until fifteen minutes after the extra arrived. Conductor of No. 93 reported a delay of one hour for extra 39, which of course, looked bad to one who did not know the circumstances.

Only a despatcher knows how often his work is delayed by offices breaking in to get "complete" to orders, and if several orders are signed, he must take time to look over the whole situation and see that the operator does not forget to deliver any of them. Then he must collect his thoughts and return to the orders he was sending, call his operators (one of whom may have "run away" during the interruption), and, when he gets well started, some station reports, "No. 5 coming," and everything must be dropped to attend to the needs of that train. Then a stock train is "all ready" at some other station, and wants to make Salt Creek for No. 2, and, if he does it, he will have to have his orders then and there. A section foreman or a train crew reports a bad spot in the track, and trains must be notified to run slow, whether any train orders are issued or not. A conductor wants to know how many tons he shall take out of Hardpull; another says his engine is leaking, and wants to know if he can reduce; some operator, who is wanted very badly, has gone out to attend to a passenger train; another has left the train wire open, and from three to ten minutes are consumed in telling him to close it; the chief despatcher or superintendent wants some information, and the despatcher must stop and give it. These, and many other interruptions, are of frequent occurrence. It has been said that all orders should be out and ready for a train before the conductor is ready to sign them. The principle is good, and should be adhered to as far as possible, but there are times when it is absolutely impossible.

Superiors should bear in mind that the despatcher ought to be handled carefully. Not that he must be regarded as a baby, but that the success of his work depends largely upon his mind being free from outside disturbances. Concentration of thought is a very essential element of successful dispatching. His office should be as nearly private as possible. He should not fill the position of operator and be required to copy and deliver orders to trains. It takes time to fix manifold and carbon sheets, write orders, fill in all the notations, and then, in the midst of important work on the wire, to leave his table and deliver from one to a dozen train orders, listen to the conductor read them, answer a number of questions, necessary and otherwise, then collect himself to return to the work on the wire.

It is not for the comfort of the despatcher that overloading is condemned; but because it is positively dangerous. In a position where one small oversight may cause serious results, it is unwise, to say the least, to so crowd a man's mind that there is danger of his not being able to retain it all. A person may be able to adjust himself to conditions where, day after day and week after week, it is simply a question of selecting the most important trains, helping them, and letting the rest stand still; but we have yet to find the man who, under these conditions, thinks of everything and does everything just at the proper moment. This is not an imaginary picture.

The matter of discipline is one worthy of attention. A man cannot do good work while smarting under a harsh or unjust criticism, or who lives in constant dread of what is known as "rawhiding." Despatchers are, as a rule, conscientious workmen, doing the best they can, trying to improve on their mistakes and get trains over the road with the least delay possible. A sharp note, containing a severe criticism and demanding an explanation, is more often irritating than beneficial. In pleasant contrast a certain train master came into the office Saturday night, after having been on the road all the week, and said that, so far as he could see, there had not been an unnecessary delay to a train that week. The boys were naturally pleased, and it can be imagined how they would endeavor to have the statement repeated at the end of the next week.

Despatchers should make frequent trips over the road. Comparatively few do this, probably because they do not have time. But few companies make any provision for this, and if a man does it, it is usually at the expense of sleep or "doubling." The former is injurious, the latter unjust. We believe if despatchers were allowed, as they are on a few roads, one day each week (or even one day a month), without reduction of pay, the service would be materially improved—under the plan of giving one day a week, each alternate "day off" he is expected to go over the road, and the other is his own.

Train orders should be signed by the despatcher who issues them, rather than by the trainmaster, superintendent or other person who has nothing directly to do with it. The despatcher issues the order without advice or assistance from anyone, is entirely responsible for the handling of trains, and would not be retained in the service if he were not capable of so doing; and yet on almost every

*Extracts from a paper by H. A. Dalby, read before the Pacific Coast Railway Club, June 18.

road in North America, the name of another is signed to the order. There is one large system on which despatchers sign their own orders.

Generally speaking, the despatcher should be at liberty to issue orders according to his best judgment. An official not familiar with despatching may, for instance, want a special train and give orders that it be put on a schedule. Sometimes the schedule is a good thing, and sometimes it is an immense amount of trouble, when the same object could be accomplished by one or two ordinary train orders. The despatcher is the man to determine that.

Mr. Dille: The best point made by Mr. Dalby is that about the "torpedoes" that the despatcher receives. You know "torpedoes" are those little notes that the despatcher sometimes receives, and which make him wish he had learned some other trade.

Mr. Wentworth: "Torpedoes" should not be given to the despatcher until after he has gone off duty. A despatcher is often handed a "torpedo" at a time when he is unraveling a bad tangle, and the receipt of such a communication disconcerts him. The reference to the trainmaster who, on returning from a week's absence on the road, commended the despatcher, reminds me that at the time of the Christian Endeavor rush, when we handled an immense number of trains and passengers. Mr. Kruttschnitt wrote a letter commending everyone for the successful handling of the traffic, and mentioned some particular instances of what he considered exceptionally good train despatching; it made the entire train despatching force feel good to think that their efforts were appreciated.

Manufacturing and Business.

The Pacific Bridge Co., of San Francisco, Cal., has been incorporated in Oregon. C. F. Swigert, of Portland, is General Agent.

Bids have been asked by the Navy Department, and will be opened Oct. 15, for the completion of the dry dock at Navy Yard, Mare Island, Cal.

D. L. Chesnut, Assistant to the President of the Western Steel Car & Foundry Company, has gone abroad for an extended trip to England and the Continent.

The Standard Grinding Machine Co., of Augusta, has been incorporated in Maine with a capital of $600,000. M. H. Simmons is President and L. J. Coleman, Treasurer, both of Augusta.

The Eastern Foundry & Machine Co., of Richland, has been incorporated in New Jersey with a capital of $200,000 by Frederick D. Hazelton, James Donald and Andrew Donald, all of Richland.

At the big electric power plant of the York Haven Water Company, at York Haven, Pa., the machinery was set in motion Aug. 22. The plant supplies York and other towns with light and power.

The Campania de Sutphen de Lavaderos de Oro, of Buenos Ayres, will soon be in the market for some additional dredging machines. D. W. Sutphen, Buenos Ayres, Argentina, is Chief Engineer.

The Eastern Railway Construction Co., of East Orange, has been incorporated in New Jersey with a capital of $125,000 to build railroads. The incorporators are: Scott Mills, Paul Hunter and Jas. R. Mapletoft.

The Universal Electric Equipment Company, of Birmingham, Ala., lately organized, is to make electric train lighting apparatus patented by J. H. Thomson, who is the chief engineer of the company. The company proposes to build a factory in Birmingham. The President is J. L. Parker and the General Manager is David Rogan.

Bids are wanted for three three-ton electric cranes and two electric locomotives for the use of the London Electric Works at Greenwich. Particulars may be had at County Hall, Spring Gardens, London, S. W., England.

The Central Iron Works Company, of Syracuse, N. Y., has bought the Economy foundry property in that city from the International Heater Co., of Utica. The plant will be put in shape for the resumption of work Sept. 1.

The South Atlantic Car & Manufacturing Co., of Waycross, Ga., is making improvements to its works, including a 100-h.p. boiler and larger machines by which the output can be increased from five cars a day to about 10 or 12.

The Mexican Car & Foundry Company, of Mexico City, it is said, has given an order for the iron-working machinery required for its new shops to the Niles-Bement-Pond Co., and for the wood-working machinery, to the J. A. Fay & Egan Co.

Dr. Hans Goldschmidt is coming to this country as the delegate of the Bunsen Society to attend the International Electric Congress at St. Louis, and in compliance with the invitation he will deliver a lecture on "Alumino-Thermis."

The Driggs-Seabury Ordnance Company, of Sharon, Pa., has been organized with a capital of $500,000, and will build a machine shop and three other buildings, on which work will be started at once. John Stevenson, Jr., is President.

The Pennsylvania, it is reported, has given a contract for the castings to be used in the Manhattan tunnel, amounting to about 54,000 tons, to the Buffalo Foundry Co. for one-half, and the balance to the J. B. & J. M. Cornell Co., of New York City.

The exhibit of the Continuous Rail Joint Company of America at St. Louis, includes various types of the company's standard rail joints for tee and girder rail sections, also insulated, step and electric bending joints. The exhibit is one of the largest of its class.

The Hale-Kilburn Metal Co. has been incorporated in Pennsylvania with a capital of $1,000,000. Treasurer, Harry G. Barnes, Philadelphia; Directors, Henry S. Hale, H. Warren, K. Hale, Harry G. Barnes, John B. Kilburn, Edw. G. Budd, all of Philadelphia.

The Rand Drill Company is shipping an Imperial Compound compressor to be used on the extension of the Chicago Drainage Canal. A compressor of the same type now in operation on this work is furnishing compressed air for ten Little Giant drills. The two compressors will have a combined capacity of furnishing 3,400 cubic ft. of free air per minute.

Arrangements are being made by Willard A. Smith, Chief of the Department of Transportation Exhibits at the World's Fair, to hold a joint meeting of all the railroad clubs of the United States and Canada at the World's Fair in St. Louis late in September or early in October. The New York Railway Club has accepted the invitation to join in this meeting.

The Electric Street Railway Company of Genoa will enlarge its present system of lines and will buy a considerable quantity of rolling stock, including electric motor cars. It is proposed to build an electric railroad between Aquila and Teramo, in the Abruzzi de Molise Compartimento, Italy, about 35 miles apart. Detailed information may be obtained from Cav. Camerini, sindaco (mayor) of Aquila.

The Morse Iron Works, Erie, Pa., has bought 17 acres of land on which it will put up buildings to cost about $150,000. President T. G. Morse was formerly Superintendent of the Jarecki Manufacturing Co.'s works at Erie. The company will make malleable and cast-iron fittings, and proposes to build a new type of pipe tapping and threading machine invented by Mr. Morse.

The Montgomery Bridge Company, recently incorporated with a capital of $150,000 in Alabama, is a consolidation of the Montgomery Road & Bridge Co. and the Montgomery Bridge Co., both of which were organized to build a steel highway toll bridge over the Alabama river at Montgomery. The consolidated company, of which A. T. Williams, of Chicago, is President, will carry out the work of building the bridge, permission having been given by the government to proceed with the work.

The Walter A. Zelnicker Supply Company, St. Louis, Mo., has combined its rail yards in East St. Louis at one location, on the Southern Railroad tracks and 24th street. A large stock of new and relaying rails is carried, and a large new warehouse contains a complete line of accessories such as angles, splices, bolts, spikes, etc. A "Daily Rail and Equipment Bulletin" is published, showing the location of different offerings. This bulletin will be mailed to any address upon application.

The U. S. Wind Engine & Pump Company, Batavia, Ill., has taken over the entire business of the Tweeddale Water Softening Company, Chicago. The business will henceforth be conducted from the office and in the name of the first-mentioned company. Messrs. C. S. Burt, L. G. Lautzenhizer, C. F. Noftzger and Wm. Freret, the operating staff of the Tweeddale Company, continue with the new concern, in its water softening department. It is the intention to push the business energetically. A description of the Tweeddale system was printed in the *Railroad Gazette* Oct. 30, 1903.

The American Car & Foundry Company is to enlarge its shops at Berwick, Pa., by putting up a building 200 ft. x 188 ft. The foundations and the steel trusses will be put up by the company's men, but contracts will probably be let for laying the brick and for the sheet metal work. A shop 729 ft. long was put up at Berwick in 1902 and fitted with machinery for making steel cars, and the present addition is to increase the capacity of this steel-car shop. These shops are at work on a contract for steel passenger cars for the Interborough Rapid Transit Company, of New York City.

In connection with the Louisiana exhibit of the rice industry, at the St. Louis Exposition, A. M. Lockett & Company, of New Orleans, have furnished the commissioners for Louisiana a model of a complete irrigation pumping plant. This model shows a Worthington conoidal pump direct connected to a compound condensing engine; the steam is furnished by a duplicate set of water tube boilers and the exhaust is condensed by a Worthington jet condenser. The feed water for the boilers is pumped from an open heater by two Worthington boiler feed pumps of the duplex type.

American Steel Foundries has received an order for cast steel body bolsters for 3,000 box cars of 60,000 lbs. capacity which are being built by Haskell & Barker for the

Southern Railway. In addition to this order American Steel Foundries' cast steel truck bolsters have been specified on 1,000 steel hopper coal cars of 100,000 lbs. capacity building for the same road by the American Car & Foundry Co., and both body and truck bolsters on 1,200 box cars of 60,000 lbs. capacity, also for the Southern, which are building at the Lenoir, Tenn., works of the Southern Car & Foundry Co.

At the annual meeting of the stockholders of the Locomotive Appliance Company, St. Louis, Mo., on Aug. 11, the following board of directors was elected: W. J. McBride, of St. Louis; J. J. McCarthy, F. W. Furry, Edw. B. Lathrop, of Chicago; J. B. Allfree, of Ironton, Ohio; Clarence H. Howard, C. A. Thompson, W. C. Squire, Ira C. Hubbell, of St. Louis; B. F. Hobart and Dr. W. G. Gale, Jr., of Springfield, Mo. Out of 8,704 shares of stock issued and outstanding, practically 8,500 shares were represented at the meeting. The Locomotive Appliance Company now has Allfree-Hubbell locomotives in successful operation on six prominent railroads, and it is claimed all are making good records in speed, hauling capacity, and economy of fuel and repairs.

The Consolidated Car-Heating Company, of New York, has just received a contract from the Interborough Rapid Transit Company, of that city, for heaters for 200 steel cars for use in the subway. There will be 24 heaters of the panel type in each car besides two for the motormen's cabs. One mile of wire will be used in the coils for each equipment. The same company also has an order for electric heaters for 100 cars for the Manhattan elevated division. The Consolidated Company has sold to date 75,000 electric heaters for use in Greater New York, more than 54,000 of which have been sold during the last three years. An order has been received from the Chicago Union Traction Company for 12-heater equipments for 100 cars, of the company's new cross seat type, also an order from Ford, Bacon & Davis, of New York, for 34 car equipments for roads in Birmingham, Knoxville and Nashville.

Iron and Steel.

The Illinois Steel Company, it is reported, will spend about $750,000 remodeling and improving its plate mills.

The Indiana Foundry & Machine Co. has completed additions to its works at South Bend, Ind., about doubling their capacity. A. A. Forsyth is General Manager.

The Lackawanna Steel Co. has an order for 5,000 tons of rails from the C., C., C. & St. L., and the Carnegie Steel Co. an order from the Lehigh Valley for 5,400 tons. The Fuller Construction Co., it is reported, is in the market for 5,000 tons of structural steel, and the South Side Elevated Railroad Co., at Chicago, for about 22,000 tons.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies see advertising page 30.)

Roadmasters and Maintenance of Way Association.

The 22nd annual meeting of this association will be held in the reading room of the Transportation building at the World's Fair, St. Louis, Mo., September 13, 14 and 15. Arrangements have been made to accommodate visitors at the Inside Inn at moderate rates both on the American and European plan.

Traveling Engineers' Association.

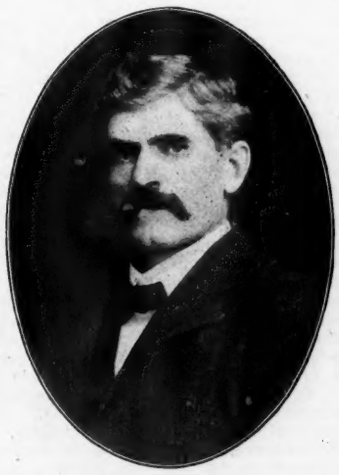
The twelfth annual convention of this association will be held in Chicago, Ill., commencing September 13. The committees are at work preparing the subjects for discussion, which have not yet been announced. Arrangements have been made to accommodate the visitors at the Lexington Hotel, Michigan Boulevard and 22d street, at a rate of $2.50 per day for each person, two in a room, on the American plan.

Technology Club of Syracuse.

This club was organized Jan. 6 last with a membership of 129, including engineers, architects, analytical chemists, metallurgists and geologists. The rooms of the club are at 707 Dillaye Building, and meetings are held monthly, except in June, July, August and September. The following are the officers: Prof. John E. Sweet, Rresident; Dean William Kent, First Vice-President; Henry C. Allen, Second Vice-President; Edward N. Trump, John H. Barr, Edmund L. French, James A. Randall, Directors; Alexander T. Brown, Treasurer; A. Frederic Witmer, Secretary. On June 4 the club took a trip over the Auburn & Syracuse Electric Railway to Auburn, N. Y., where several large manufacturing plants were visited. Visits to manufacturing plants are to be made a feature.

PERSONAL.

—Mr. W. E. Symons, who has been appointed Superintendent of Machinery of the Kansas City Southern, was educated at Dublin Academy in Indiana. In 1881 he became machinist on the Chicago, Rock Island & Pacific, where he served his full apprenticeship. From 1885 to 1887 he was Locomotive Engineer and Engineer of Tests on the Wisconsin Central, and following this, for a period of several years, he was Chief Engineer in the Merchant Marine service. He also did some special engineering work



in California and some electrical engineering in Chicago. In 1890 he went to the Atchison, Topeka & Santa Fe, first as general foreman at Chanute, Kan., and then for four years Master Mechanic at Arkansas City, Kan., and at Raton, N. Mex. In 1896 he went to the Mexican Central as Master Mechanic at San Luis Potosi. In the latter part of the same year he went to England as U. S. representative of the Galena Oil Co. Two years later, he became Superintendent of Motive Power and Equipment of the Plant system of railroads. He remained here until 1902, when he became Mechanical Superintendent of the Gulf, Colorado & Santa Fe. Here he remained until he resigned to go to the Kansas City Southern. He is a member of the Master Car Builders' and Master Mechanics' Associations; the American Society of Mechanical Engineers; the Franklin Institute of Philadelphia, and the Foreign Railroad Club, of London, England.

—Mr. J. Lowber Welsh, who died at his country home at Whitemarsh, Pa., on August 21, was well-known in railroad financial circles. At one time he was a member of Drexel & Co., but of late years had not been actively engaged in business. At the time of his death, Mr. Welsh was a director in the Erie, the Central of New Jersey, and the Philadelphia & Reading railroads.

—Mr. George W. Creighton, General Superintendent of the Pennsylvania Railroad Division of the Pennsylvania Railroad, at Altoona, who has been absent from his post for many months on account of ill health, has now recovered and it is said that he will resume his duties on September 1, relieving Mr. Trump, General Superintendent of Transportation, who has performed the duties of General Superintendent during Mr. Creighton's absence.

—The body of Mr. George B. Cliff, Superintendent of the Seattle Division of the Northern Pacific, who was reported missing in our issue of August 19, has been found in the Sammamish river near Kenmore, Wash. Mr. Cliff had been in the service of the Northern Pacific for 15 years, and was formerly with the Union Pacific. According to the reports of the searching party, Mr. Cliff was on an inspection trip, when his boat, which was of canvas, probably became waterlogged.

—Mr. Marcus Smith, who died at Ottawa on August 14th in his 90th year, was well-known in connection with many important railroad undertakings in Canada. He was born in England and came to America in 1849. After practising engineering in Canada he went to South Africa, where he was engaged in railroad work. He returned to Canada in 1868 and took part in the construction of the Intercolonial, subsequently becoming deputy to the engineer in chief of the Canadian Pacific.

—Mr. C. S. Rogers, who recently lost his life by falling over a precipice while making surveys for the Western Pacific, was well-known in the west as a skillful engineer. He was graduated from the University of Iowa, and entered railroad service in 1882. Since that time he has made surveys and had charge of the construction of new lines, for the C., B. & Q., Burlington, Cedar Rapids & Northern, and Northern and Union Pacific railroads. At the time of his death he was Resident Engineer for the Western Pacific.

—Mr. H. D. Lumsden, who has been appointed Chief Engineer of the Eastern Division of the Grand Trunk Pacific, began his railroad career in 1870, when he was engineer in charge of the location of the northerly portion of the Toronto & Nipissing. He was afterwards in charge of surveys on the Northern Railroad, the Credit Valley, the Georgian Bay branch of the Canadian Pacific, both for the contractors and the Government, and on the C. P. main line, including surveys in the Crow's Nest Pass. He was Chief Engineer of location and construction of the Ontario & Quebec from Toronto Junction to Perth, and served in a similar capacity for a number of other companies.

—Prof. William G. Raymond, of Rensselaer Polytechnic Institute, has been asked to assume charge of the Engineering Department of the Iowa State University, and it is understood that he has accepted. The sum of $50,000 was appropriated by the last Legislature toward an engineering building, and $10,000 toward the building of a dam for the development of power in the Iowa

River, which bounds the university campus on the west. Under the reorganization there will be separate chairs of Mechanics, Railroad Engineering, Structural Engineering, Hydraulic and Sanitary Engineering, Drawing, Electrical Engineering, Mining Engineering, Chemical Engineering, Steam Engineering, and Architecture.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe.—F. M. Bisbee has been appointed Engineer of the Western Grand Division, with headquarters at La Junta, California, succeeding H. C. Phillips, promoted.

Atlantic Coast Line.—A. W. Tritot has been appointed General Agent at Havana, Cuba.

Baltimore & Ohio.—H. E. Hale, Superintendent of the Butler division, which is to be absorbed by the Pittsburg division, will become Division Engineer of the Baltimore Division, succeeding M. C. Byers, who has resigned to enter the service of the Rock Island.

Buffalo & Susquehanna.—H. H. Gardiner, General Freight and Passenger Agent, has been appointed Second Vice-President of the Susquehanna Coal & Coke Co., in charge of traffic sales. J. W. Trounce, Car Accountant, at Buffalo, has been appointed General Sales Agent for the same company.

California Northwestern.—See North Shore.

Chicago, Rock Island & Pacific.—W. C. Ball has been appointed General Time Inspector, with headquarters at Chicago, Ill., succeeding J. W. Forsinger.

Grand Trunk Pacific.—The Government commissioners to build the Eastern Division of this proposed road have been named as follows: F. B. Wade, Chairman; C. A. Young, of Winnipeg, representing the West; Robert Reid, of London, representing Ontario and Alfred Brunet, of Montreal, representing Quebec. H. D. Lumsden, of Toronto, is Chief Engineer, and P. E. Ryan, former Secretary to the Ontario Minister of Public Works, and later Secretary of the Temiscaming Railroad Commission, is Secretary.

Kansas City Southern.—M. T. Sullivan, Trainmaster at Pittsburg, Kan., has been appointed Superintendent of the Southern Division, with headquarters at Texarkana, Tex., succeeding E. Phenneger, resigned.

North Shore.—J. W. Lilienthal, General Counsel of the California Northwestern, has been elected First Vice-President of the North Shore. A. W. Foster, Jr., has been elected Second Vice-President, with headquarters at San Francisco.

T. Mellersh, Secretary and Controller of the California Northwestern, has been appointed Controller of the North Shore, with headquarters at San Francisco.

Parral & Durango.—G. F. Moore, heretofore Chief Traveling Auditor of the Chicago & Alton, has been appointed Auditor of the Parral & Durango, with headquarters at Parral, in the State of Chihuahua, Mexico.

Pere Marquette.—Newman Erb, Vice-President, announces his intention of resigning his position.

Southern.—Announcement is made of the following appointments, effective September 1: G. G. Thompson, Jr., Division Freight Agent, Birmingham, Ala., succeeding G. R. Browder, promoted; Randall Clifton, Division Freight Agent, Raleigh, N. C., succeeding G. G. Thompson, Jr., promoted; R. K. Barton, Traveling Freight Agent, Tampa, Fla., succeeding W. B. McGroarey, promoted to be Chief Clerk to freight traffic manager; N. R. Keeling, Traveling Freight Agent, Piedmont Air Line, Baltimore, succeeding R. K. Barton, promoted.

Toledo, St. Louis & Western.—F. McArdle, Assistant Superintendent, has been appointed Division Superintendent at Frankfort, Ind., in place of K. A. Gohring, resigned. F. P. Lapham has been appointed Superintendent of Telegraph, with headquarters at Frankfort.

White River.—J. R. Tupper has been appointed General Manager, with headquarters at Rochester, Vt., succeeding C. E. Calvin, resigned.

LOCOMOTIVE BUILDING.

The Illinois Southern, as reported in our issue of August 19, has ordered two mogul (2-6-0) locomotives from the Baldwin Locomotive Works. These locomotives will weigh 129,000 lbs., with 114,000 lbs. on drivers; cylinders, 20 in. x 24 in.; diameter of drivers, 58 in.; and working steam pressure, 200 lbs.

The Atchison, Topeka & Santa Fe, as reported in our issue of August 12, is having eighteen new balanced compound locomotives built at the Baldwin Locomotive Works for September, 1904, delivery. These locomotives will weigh 201,500 lbs., with 99,200 lbs. on drivers; cylinders, 25 in. x 26 in.; diameter of drivers, 23 in.; wagon-top boiler, with a working steam pressure of 220 lbs.; heating surface, 3,206 sq. ft.; 273 Tyler iron tubes 2¼ in. in diameter and 18 ft. 10 in. long; fire-box, 108 in. long by 66 in. wide; grate area, 49.5 sq. ft.; tank capacity, 8,500 gallons of water, and coal capacity, 12 tons. Special equipment includes: Westinghouse-American air-brakes, Franklin Manufacturing Co.'s boiler lagging, American Brake Shoe & Foundry Co.'s brake shoes, Tower couplers, Pyle-National electric headlights, Ohio injectors, Hewitt Mfg. Co.'s journal bearings, U. S. metallic piston-rod and valve-rod packings, Crane safety valves, Leach sanding devices, Ohio sight-feed lubricators, Simplex Railway Appliance Co.'s springs, Standard Steel Works driving, truck and tender wheels, cast-steel wheel centers, Gollmar bell ringers and Bethlehem Steel Co.'s and Standard Steel Works axles.

The Nashville, Chattanooga & St. Louis, as reported in our issue of August 5, is having eight consolidation (2-8-0) and two switching (0-6-0) locomotives built at the Baldwin Locomotive Works. The 2-8-0 locomotives will weigh 166,200 lbs., with 150,000 lbs. on drivers; cylinder, 21 in. x 28 in.; diameter of drivers, 55⅝ in.; straight boiler, with a working steam pressure of 195 lbs.; 267 charcoal iron tubes, 2¼ in. in diameter and 14 ft. 6 in. long; fire-box, 102 in. long and 65⅞ in. wide; grate area, 46.5 sq. ft.; tank capacity, 5,000 gallons of water, and coal capacity, 10 tons. The 0-6-0 locomotives will weigh 130,000 lbs.; cylinders, 19 in. x 26 in.; diameter of drivers, 50 in.; working steam pressure, 180 lbs.; 270 charcoal iron tubes 2 in. in diameter and 10 ft. 11¾ in. long; fire-box, 103 3/16 in. long and 32⅜ in. wide; grate area, 23.19 sq. ft.; tank capacity, 3,500 gallons. Special equipment for both includes: Westinghouse-American air-brakes, hammered steel axles, Gollmar bell ringers, sectional magnesia boiler lagging, tower couplers, bronze journal bearings, Simplex No. 10 injectors, Jerome piston-rod and valve-rod packings, Coale safety valves, Leach sanding devices, Nathan sight-feed lubricators, Railway Steel-Spring Co.'s springs, Crosby steam gages, Sterlingworth and Baldwin Locomotive Works brake-beams and J. W. Thomas, Jr., pneumatic cylinder cock openers.

CAR BUILDING.

The Gulf & Ship Island is reported in the market for 250 box cars.

The Hocking Valley has ordered 80 freight cars from Barney & Smith.

The Baltimore & Ohio is in the market for 1,000 gondolas of 100,000 lbs. capacity.

The Georgia Southern & Florida has ordered two passenger coaches from Barney & Smith.

The Cleveland, Cincinnati, Chicago & St. Louis is reported in the market for a number of cars.

The Chicago & Western Indiana is in the market for 28 suburban cars and two combination cars.

The Atlantic Coast Line has ordered 500 ventilated box cars from the South Baltimore Car & Foundry Co.

The Metropolitan Street Railway (New York) has ordered 150 cars from the J. G. Brill Co., of Philadelphia.

The Baltimore & Ohio has ordered 250 refrigerator cars from the South Baltimore Steel Car & Foundry Company, at Curtis Bay, Md.

The Atchison, Topeka & Santa Fe has ordered seven coaches, one chair car, one standard baggage and mail car and two standard baggage cars from the Pullman Co.

The Wheeling & Lake Erie is reported to have ordered 1,000 box cars from the American Car & Foundry Co., and 500 steel freight cars from the Standard Steel Car Co.

The Detroit Southern, through its receiver, Samuel Hunt, has given an order to the American Car & Foundry Co. for repairing between 800 and 1,000 freight cars at the Detroit Works.

The Richmond, Fredericksburg & Potomac is having four passenger coaches built at the Wilmington Works of the American Car & Foundry Co. This order was reported as let in our issue of August 12.

The St. Louis Southwestern has not ordered 100 stock cars from the American Car & Foundry Co., as reported in our issue of August 12, but is having the bodies of these cars replaced, using the old trucks.

The Pennsylvania Refining Company, Oil City, Pa., has ordered three steel tank cars from the American Car & Foundry Company, and three steel tank cars from the Bettendorf Axle Company. The latter have a capacity of 12,000 gallons.

The Southern is having 1,200 box cars of 60,000 lbs. capacity built at the works of the Southern Car & Foundry Co., at Lenoir, Tenn. The specifications for these cars were given in our issue of April 8. The company is also having 1,000 steel hopper cars of 100,000 lbs. capacity built by the American Car & Foundry Co.

BRIDGE BUILDING.

Atlanta, Ga.—The Atlanta, Knoxville & Northern and the city officials have reached an agreement for the latter to build the Washington street viaduct, toward the cost of which the railroad will contribute $50,000.

The bids recently opened for the Magnolia street bridge ranged from $15,500 to $22,610. The contract has not yet been awarded.

Chicago, Ill.—Bids are wanted October 12 by S. D. Griffin, Clerk of the Board of Trustees of the Sanitary District of Chicago, for building the superstructures of bridges at Ninth street, Lockport road, and at 16th street, Wire Mills road, over the main drainage canal.

Chicopee, Mass.—Plans are being made by White & Towne, Springfield, for a steel bridge over the Connecticut river, for which $150,000 has been appropriated.

Columbus, Ohio.—Bids are wanted September 14 by the Board of County Commissioners for building two bridges over the Scioto river.

Delphi, Ind.—Bids are wanted September 7 by F. H. Engel, County Auditor, for building stone or concrete piers and abutments for two bridges in Tippecanoe township, over the river of the same name, and in Clay township.

Elwood, Ind.—The Council has authorized the building of bridges on North 16th, South 27th, Main and South B streets.

Indianapolis, Ind.—Bids have been opened by the Board of Public Works for the

new bridge over Fall creek, at Northwestern avenue. The lowest bid was that of E. M. Graves, for a Melan arch, $44,848, and $63,000 for a stone arch. The other bids were: For stone arch bridge—Williams Bros. & Morse, $78,300; M. M. Defrees, $83,682; Moore-Mansfield Construction Company, $79,000, and Fidelity Construction Company, $68,000. For concrete steel bridge—Williams Bros. & Morse, $50,745; M. M. Defrees, $49,695; Moore-Mansfield Construction Company, $45,790; Fidelity Construction Company, $54,490; Collier Bridge Company, $47,604; Shover & Pease, $48,949; A. J. Yawger & Co., $48,975; Union Asphalt Construction Company, $50,000, and J. B. Marsh, $60,000.

KANSAS CITY, MO.—The Upper House of the Council has granted a franchise to the Kansas City Viaduct & Terminal Co. to build a steel toll viaduct 62 ft. wide to carry two tracks, from Sixth street to a point on Ferree street, in Kansas City, Kan. The proposed viaduct will cost, it is estimated, $2,250,000.

The city has agreed to build the Lydia avenue viaduct; it will cost about $200,000. The Missouri Pacific, Chicago & Alton and the Metropolitan Street Railway Co. will pay a part of the cost.

MARLIN, TEX.—The County Commissioners have been petitioned to build a bridge over the Brazos river in the southern part of Falls County, to cost about $22,000.

MITCHELL, S. DAK.—Bids are wanted September 6 by O. D. Stearns, County Auditor, for building a steel bridge in Davison County.

NEW ORLEANS, LA.—Plans are ready for the new viaduct which is to be built at Newton street, and bids will be asked at the next meeting of the City Council.

OAKLAND, MD.—Bids are wanted September 13 by A. G. Ross, Clerk of the County Commissioners, for building an iron bridge 70 ft. long over the Youghiogheny river.

PHILADELPHIA, PA.—An ordinance has been signed by Mayor Weaver appropriating $1,000,000 for building new bridges. On some of the bridges work will be begun at once, namely: On Erie avenue, to cost $58,000; on Thirty-third street, $110,000; to span the Schuylkill on Passyunk avenue, $500,000, and three on the line of the new Torresdale boulevard, to cost $182,000. The Erie avenue bridge will cross the Richmond branch of the Philadelphia & Reading Railway. The 33d street will open up a new entrance to Fairmount Park. The abutments and piers for this bridge, which will span the Connecting Railroad and the Philadelphia and Reading Railway, are already up. The half million dollars for the Passyunk avenue bridge is to continue the work upon that structure, which will be of the bascule or lift bridge type. It will cost about $800,000, and will join the southern section of the city with southern West Philadelphia. Of the three bridges on the line of the Torresdale boulevard, one, to cost $100,000, will span Tacony creek and Ashdale street; another will cross the Philadelphia, Newtown & New York Railroad, and the third will cross the North Pennsylvania Railroad. Plans have been approved by the Board of City Surveyors for a concrete arch bridge over the Chestnut Hill Branch of the Philadelphia & Reading, at Graver's lane; also plans for the proposed bridge over the Richmond Branch of the same railroad, on the line of Erie avenue.

SCOTTSBORO, ALA.—The Commissioners' Court has given a contract to the Converse Bridge Company, of Chattanooga, for seven steel bridges at $13,447, to be built in Jackson County.

WALLA WALLA, WASH.—Plans are ready for building the bridge over Dry Creek. L. W. Loehr is County Surveyor.

YORK, PA.—The old wooden railroad bridge over Codorus creek near Philadelphia street, is being removed and a single-track, two-span steel bridge will replace it.

Other Structures.

AUSTIN, TEX.—A mass meeting was held August 16 to consider ways and means for rebuilding the dam across the Colorado river. The chairman of the meeting was Mr. Wooldridge, a banker. A dam would cost from $600,000 to $1,000,000, but it is believed that it could be used to furnish light and power so as to bring a good return on the investment.

BALTIMORE, MD.—The Baltimore & Ohio, it is said, has plans ready for building an extension eight stories high, 50 ft. x 416 ft., to its terminal warehouse at Camden station, at a cost of about $250,000.

CHATTANOOGA, TENN.—The Chattanooga Electric Railway Co. will build car barns, machine shop and a blacksmith shop, and put in a steam hammer and wood-working machinery.

CLEVELAND, OHIO.—The Baltimore & Ohio, it is reported, is making plans to build a new freight house and enlarge its yards.

FORT SMITH, ARK.—The Fort Smith & Western, it is reported, will build a new freight house, to cost $20,000.

GLENWOOD, IOWA.—The Chicago, Burlington & Quincy, it is said, will build a new brick passenger station.

GREENVILLE, N. J.—The Pennsylvania has given a contract to F. M. Stillman & Co., of Jersey City, for a roundhouse, machine shops, boiler rooms and oil house.

LODI, OHIO.—The Baltimore & Ohio, it is reported, has bought land on which it is planning to build shops.

LONDON, ONT.—The Grand Trunk has given a contract to John Hayman & Sons, of London, for building its new roundhouse, to cost about $40,000.

NEW ROCHELLE, N. Y.—The New York, New Haven & Hartford, it is said, will build a new passenger station here.

OAKLAND, CAL.—The Oakland Transit Consolidated Co. has plans ready to put up car repair shops in North Oakland.

PRINCETON, IND.—The Southern, it is reported, will spend $25,000 for improvements to its shops; new buildings will be added in which to erect cars.

ROCHESTER, N. Y.—The Rochester Railway Co. has bought five acres of land at Glen Haven, as a site for car barns and repair shops.

SEATTLE, WASH.—A building permit has been granted to build a three-story brick and stone union passenger station, to cost about $425,000.

WINNIPEG, MAN.—The Dominion Government has given a contract to the Manitoba Construction Co. for a new stone and brick immigration building, to cost about $200,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ATLANTA, KNOXVILLE & NORTHERN.—A contract has been let to W. J. Oliver & Co., of Knoxville, Tenn., for rebuilding the main line of this road between Knoxville and Wetmore, 60 miles. The work will necessitate an expenditure of about $2,000,000. Grading will be begun at once. (August 5, p. 51.)

BAY CITY & CARO (ELECTRIC).—Articles of incorporation have been filed by this company in Michigan. It is proposed to build an electric railroad from Bay City to Caro, 30 miles. E. A. Mather, Bay City, Mich., and F. Slocum, Caro, are directors.

CAMBRIA SOUTHERN.—A charter has been granted this company in Tennessee with headquarters at Knoxville. It is proposed to build from Cave Creek, on the Atlanta, Knoxville & Northern, to a point in Polk County, Georgia, near the Conesauga river. H. W. Oliver, J. H. Frantz and others are incorporators.

CHICAGO & NORTHWESTERN.—A contract is reported let to Paulson & Larsen, of Minneapolis, for building a railroad 10 miles long east of Rat river, in Forest County, Wisconsin. The work will be finished in about three months.

CINCINNATI, HAMILTON & DAYTON.—Contracts for rails and ties are reported let for building the branch line from Dayton, Ohio, west to Richmond, Ind., 40 miles. Surveys are now in progress, and it is stated that the contract for grading will shortly be let. A connection will be made with the Chicago, Cincinnati & Louisville at a point a few miles south of Richmond.

DELTA SOUTHERN.—A charter has been granted to this company in Alabama. The road is projected to run through Washington, Bolivar, Sharkey and Yazoo Counties for a distance of 60 miles. M. M. Richey, Birmingham, Ala.; W. W. Stone, Greenville, Ala., and others are incorporators.

ERIE & MICHIGAN RAILWAY & NAVIGATION COMPANY.—Maps have been filed by this company showing the location of its proposed line from Alabaster, in Iosco County, Michigan, to a connection with the Michigan Central and the Detroit & Mackinac in the same county. The road will be about 30 miles long. T. F. Robinson, Alabaster, Mich., is interested. (July 22, p. 41.)

GRAND RAPIDS & CHICAGO.—This company has filed amended articles of incorporation, changing its name to the Grand Rapids & Kalamazoo Valley. The company was originally organized for the purpose of building an electric railroad from Grand Rapids, Mich., to Kalamazoo, a distance of about 55 miles.

GRAND RAPIDS & KALAMAZOO VALLEY.—See Grand Rapids & Chicago above.

GRAND RAPIDS TERMINAL.—Articles of incorporation have been filed in Michigan with a capital stock of $50,000. This company has been organized by the Grand Trunk for the purpose of building an extension of its Detroit, Grand Haven & Milwaukee division from its present station along the bank of Grand river to Pearl street, in the city of Grand Rapids.

ILLINOIS CENTRAL.—Announcement is made that this company has finished its second track between Memphis and Fulton, Ky., 122 miles. This work was begun two years ago, and by its completion the company now has 475 miles of double track between Memphis and Chicago. The entire line is laid with 85-lb. rails. (See Construction Supplement.)

LONE ROCK & LA VALLE.—At a meeting of the directors of this company, on August 17, it was voted to begin surveys at once. The proposed route is from Lone Rock, Wis., through Plano, White Mound and Ironton to La Valle, 35 miles. George Jameson, Lone Rock, Wis., may be addressed. (See Construction Supplement.)

LOUISVILLE & NASHVILLE.—It is reported that this company has bought a right of way into Atlanta, Ga., from Kennesaw.

MEMPHIS, PARIS & GULF.—Application has been made by this company for a charter to build a railroad from Memphis, Tenn., through Little Rock, Ark., to Paris, Tex., about 400 miles. J. W. Brown, Camden, Ark., is President, and C. C. Henderson, Arkadelphia, Ark., is General Manager.

MENA, HOT SPRINGS & EASTERN.—Surveys have been finished and work will be begun in October on this proposed road which is to extend from Mena, Ark., via Black Springs, to Hot Springs, 85 miles. G. H. Cravens, Mena, Ark., is Chief Engineer. (July 15, p. 35.)

MENTOR SOUTHERN.—Incorporation has been asked for by this company in Tennessee to build a railroad from Mentor to McGhee, running through Blount, Loudon and Monroe counties, a distance of 20 miles. Connection will be made with the Atlanta, Knoxville & Northern at Mentor. W. H. Oliver, J. B. Wright, J. H. Frantz and others are interested. It is said that this is a project of the Atlanta, Knoxville & Northern.

Ontonagon & Southwestern.—Incorporation has been granted this company in Michigan, with an authorized capital stock of $200,000. It is proposed to build a railroad from Ontonagon in a southwesterly direction for a distance of 25 miles. D. J. Norton, Ontonagon, Mich.; T. G. Sullivan, Detroit, and A. S. Nester, Saginaw, are directors.

Orange & Northwestern.—Press reports state that this road, which has recently been extended from Orange, Tex., to Buna, will be extended 35 miles further to Newton. Connection will be made at the latter point with the Cotton Belt. M. L. Montanden, Orange, Tex., is Chief Engineer. (See Construction Supplement.)

Quebec & Lake St. John.—J. G. Scott has returned from Europe and announces that he has arranged for the building of the branch line to the headwaters of the St. Lawrence River at La Turque, for which surveys are now being made.

Rochester, Syracuse & Eastern.—The contract for grading the first 15 miles of this road out of Rochester, N. Y., has been let to F. T. Ley & Co., of Syracuse. Work is now in progress. T. H. Mather, Syracuse, N. Y., is Chief Engineer. (April 22, p. 314.)

St. Louis, Brownsville & Mexico.—A contract is reported let to Johnston Bros. for building an extension from Sinton, Tex., northeast through Refugio and Lacedo to Bay City, 150 miles. It is stated that grading will be begun at once. F. G. Jonah, Corpus Christi, Tex., is Chief Engineer. (July 8, p. 30.)

Saline Valley.—This company has been incorporated to build a railroad from Lithium, on the Chester, Perryville & Ste. Genevieve, northwest to Saline river, thence up the river to a connection with the Iron Mountain road. The road will pass through the Counties of Perry, Ste. Genevieve, Saint Francois and Madison for a distance of about 40 miles. R. B. Andrews is interested.

Western Maryland.—It is reported that about $18,000,000 will be spent on improvements of this line and the West Virginia Central & Pittsburg. It is announced that $1,734,000 will be expended on Baltimore terminals, $4,900,000 on West Virginia Central & Pittsburg underlying bonds, $2,581,000 on the Western Maryland road, and $13,703,700 on construction and extensions of the two roads.

Wyoming Central.—Press reports state that the details of the plans for building this line, have been settled and that contracts will now be signed with Kilpatrick Bros. & Collins, Denver, Colo., for the work. The road will be built west from Orin Junction, Wyoming, through Douglas and Casper to Lander, 250 miles. A branch line will also be built from Casper, 75 miles north to Salt Creek oil fields.

RAILROAD CORPORATION NEWS.

Baltimore & Ohio.—The Butler division, comprising the line between Butler and Kane, Pa., 112 miles, a portion of which is narrow gage, will on September 1 be merged into the Pittsburg division. The division was separated from the Pittsburg division only about a year ago.

Brooklyn Rapid Transit.—The annual report of this company shows gross earnings of $14,738,709, an increase of $1,458,388 over 1903. Operating expenses increased $829,359, leaving an increase in net earnings of $629,029. The surplus for the year, however, decreased $153,650, owing to writing off the sum of $1,153,200, discount on bonds sold.

Chicago Great Western.—It has been announced that the dividend of 2½ per cent. which was expected to be declared August 31 on the $11,300,000 preferred A stock will be passed. This action has been taken because of a falling off in earnings. A dividend of 5 per cent. per annum has been paid on this stock regularly since January, 1900.

Cincinnati, Hamilton & Dayton.—A committee representing holders of more than twenty thousand shares of the 5 per cent. preferred stock, and consisting of Lawrence Maxwell, Jr., E. L. Heinsheimer and J. S. Graydon, announce that they have satisfactorily settled the differences between the company and the minority preferred stockholders, over the recent issue of securities to acquire the controlling interest in the stock of the Pere Marquette. Under the terms of this arrangement all the 5 per cent. preferred stock of the C. H. & D. will be taken up at $10 a share. Stockholders are requested to deposit their certificates with P. J. Goodhart & Co., 326 Walnut street, Cincinnati, before September 30.

Grand Trunk Pacific.—Hon. Raymond Prefontaine, Canadian Minister of Marine, at present on an official tour in British Columbia, stated at a meeting held in Vancouver on August 16, that it was the intention of the officers of the Grand Trunk Pacific to shortly begin work on the western sections of the line at both ends, building from Winnipeg west and from the Pacific coast east. The Canadian government, which is to build the eastern section, from Winnipeg to Moncton, will also begin work at both ends of that part of the line. While Mr. Prefontaine is in British Columbia he will examine the points proposed as the Pacific terminus of the G. T. P., including Port Simpson, Kitemat and a third harbor lying south of Port Simpson. The selection must have the approval of the government. The party of G. T. P. officials who propose to locate the terminus of the line left Montreal for the Pacific coast August 17. The party included Messrs. Hays, Morse, Wainwright, Stephens and Hobson, and Mr. Parent, Premier of Quebec Province.

Great Northern (Canada).—The bondholders have agreed upon a committee to represent them in reorganizing the company. The committee consists of William L. Bull, of New York, Chairman; H. E. Mitchell, of Philadelphia; G. B. Baker, of Boston;, J. N. Wallace, Vice-President of the Central Trust Co., of New York, and George Burn, of Ottawa. The Central Trust Co. is now receiving deposits of the bonds preliminary to the submission of a plan by the committte.

Lehigh Valley Traction.—The receivers have issued their plan for reorganization. This company embraces the Philadelphia & Lehigh Valley Traction, the Allentown & Slatington Street and the Coplay, Egypt & Ironton Street railroads. A new company is to be formed which is to issue $5,000,000 first mortgage, 30-year gold bonds, bearing 4 per cent. interest; $7,500,000 consolidated mortgage, 30-year bonds; $5,000,000 preferred and $3,000,000 common stock. The stock of the new company is to be vested for a period of three years in seven voting trustees.

Louisville & Nashville.—A notice has been sent to all stockholders that at the next meeting (October 5) a vote will be taken to acquire by purchase or consolidation the Knoxville, La Follette & Jellico, and the Atlanta, Knoxville & Northern railroads.

Pere Marquette.—As a result of the consolidation with the Cincinnati, Hamilton & Dayton, a refunding mortgage for $65,000,000 has been made by this road, with the New York Security & Trust Company as trustee. The mortgage secures an issue of 50-year, 4 per cent. gold bonds, a large part of which will be used to refund outstanding bonds amounting to $46,733,185.

Terminal R. R. Association of St. Louis.—Harvey Fisk & Sons are offering at 99½ and interest $1,000,000 of the general mortgage, refunding, 4 per cent., 50-year gold bonds. This is part of the authorized issue of $50,000,000 for which see February 20, 1903, p. 142.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
PUBLISHED EVERY FRIDAY BY
THE RAILROAD GAZETTE
At 83 Fulton St., New York.

EDITORIAL ANNOUNCEMENTS:

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages and all of the advertisement pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name, Transport and Railroad Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

FRIDAY, AUGUST 26, 1904.

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